December 1990

AN ECONOMIC IMPACT ANALYSIS OF THE PROPOSED YAKIMA/KLICKITAT FISHERY ENHANCEMENT PROJECT

DOE/BP-00245-5

This report was funded by the Bonneville Power Administration (BPA), U.S. Department of Energy, as part of BPA's program to protect, mitigate, and enhance fish and wildlife affected by the development and operation of hydroelectric facilities on the Columbia River and its tributaries. The views of this report are the author's and do r necessarily represent the views of BPA.

This document should be cited as follows:

The Bonneville Power Administration, Fish and Wildlife Division, Under Agreement No. DE-AI79-1989BP96453,Mack,Richard S., Donald J. Cocheba, Daniel Green, David W. Hedrick, Central Washington University, 272 electronic pages (BPA Report DOE/BP-00245-5)

This report and other BPA Fish and Wildlife Publications are available on the Internet at:

http://www.efw.bpa.gov/cgi-bin/efw/FW/publications.cgi

For other information on electronic documents or other printed media, contact or write to:

Bonneville Power Administration
Environment, Fish and Wildlife Division
P.O. Box 3621
905 N.E. 11th Avenue
Portland, OR 97208-3621

Please include title, author, and DOE/BP number in the request.

AN ECONOMIC IMPACT ANALYSIS
OF THE PROPOSED
YAKIMA/KLICKITAT FISHERY ENHANCEMENT PROJECT

Prepared for
The Bonneville Power Administration,
Fish and Wildlife Division
Under Agreement No. DE-AI79-89BP96453

BY
Richard S. Mack
Donald J. Cocheba
Daniel Green
David W. Hedrick

Central Washington University

December 27, 1989

EXECUTIVE SUMMARY

Objective

The objective of this study is to estimate the economic impact of the proposed Yakima/Klickitat Production Project on the local economies of the Yakima and Klickitat subbasins. The project, when operating at planned maximum production, will augment the total number of salmon and steelhead returning to the subbasins by 77,600 and will increase the sustainable terminal harvest by 55,160. These estimates do not include fish harvested in the ocean or in the mainstem Columbia. In addition to evaluatlng the impacts of the construction, operations and maintenance, experlmentation and monitoring, and harvest activities described in the Draft Environmental Assessment (Bonneville Power Administration, 1989), our analysis also evaluates some passageway improvements and Phase II screening of irrigatlon structures. Both of these augmentations are required In order for the project to reach maximum planned harvest levels. The study area includes the Yakima Subbasin economy (Yakima and Kittitas counties), the mid-Columbia Basin/Klickitat Subbasin economies (Klickitat, Hood River, and Wasco counties), and the Tri-Cities economy (Benton and Franklin counties). The study period extends from 1990 through 2015: from preconstruction planning activities through reaching maximum production.

Analytical Procedures

The analysis estimates both the initial spending on project activities and the subsequent rounds of respending. To estimate initial spending, we developed models that allocate direct impacts to individual counties for specific years. We then used these models to derive location-specific direct impacts from expenditures made on construction, operations and maintenance, experimentation and monitoring, and harvest.

Use of both an input-output model and an econometric model enabled us to estimate the secondary effects upon the economy. These effects result when direct expenditures cause additional rounds of economic activity in an economy.

Findings

We estimate that during the 1990 through 2015 period, the project will develop 6,875 person-years of employment, $132,424,280 of income, and $33,859,760 of taxable sales in the study area.

In a typical year during the construction phase the study area is estimated to experience increases of 143 jobs, $4,036,856 in income, and $8,753,135 in output. The construction sector will experience the greatest change in output, whereas the service sector will experience the greatest increase in income and employment.

In a peak harvest year, the study area will experience estimated increases of 409 jobs, $8,507,806 in income, and $17,627,154 in output. The service and trade sectors are estimated to account for 82% of these changes.

In the peak construction year, sales tax collected in the region will increase by $587,970. In the maximum production year, sales tax collected will increase by $691,690.

The study also indicates that

- Construction period impacts will peak in 1994.
- Harvest period impacts will peak in 2015.
- The project will increase employment in an area that generally suffers from high unemployment and youth out-migration.
- The project will stimulate entrepreneurial activities in the study area.
- There will be no construction boom and bust, but a relatively steady increase in jobs and income.
- The new jobs will bring a mixed quality of employment to the region: high income employment will be associated with construction, operations and maintenance, and experimentation and monitoring, while lower income employment will stem from service sector and trade activities during the harvest period.
- The project will aid in the structural evolution of the study area's economy.

PREFACE

In 1982 the Northwest Power Planning council identified the Yakima and Klickitat rivers as the most promising tributaries of the Columbia for enhancement of anadromous fisheries. The two rivers are practically free of large impoundments and have supported large salmon and steelhead runs prior to the development of hydroelectric dams and navigational facilities on the Columbia River. The Bonneville Power Administration, the agency responsible for implementing the recommendations of the Council, has initiated a comprehensive program within the Yakima and Klickitat subbasins to rebuild anadromous runs by improving fish passage facilities, screening irrigation structures, and constructing a fish hatchery system. The proposed Yakima and Klickitat fishery enhancement program will have major impacts upon the economies of the projected area, both during the construction phase and during long term operations. Economic flows will arise from expenditures associated with construction, operation and maintenance, experimentation and monitoring, and harvest. This study identifies and estimates the impacts of these expenditures.

The Executive Summary (p. i) briefly explains our objectives, procedures and findings. Descriptions of the region, the hatchery enhancement project, the economic methodologies, and the time periods under consideration are presented in Chapters 2, 3, and 4.

Direct impacts upon the region are presented in Chapter 5, along with an explanation of the procedures by which we derived these impacts. The tables in Appendix J show direct impacts at the county level for each of the 25 years of our study period.

In Chapters 6 and 7, we present the indirect and induced impacts. These impacts capture the secondary effects as the initial expenditures continue to cycle through the economy. Indirect and induced impacts for geographic subcomponents of the study area are also presented in these chapters.

Chapter 8 not only summarizes the quantitative impacts on the study area, but also presents a discussion of a number of qualitative findings. Eleven appendices explain the more technical aspects of the study.

ACKNOWLEDGEMENTS

The authors of this report are indebted to many individuals and the personnel of public and private sector institutions for their critical insights and for their assistance in collecting data. First, we express our appreciation to Thomas Clune, of the Bonneville Power Administration's Fish and Wildlife Division, for his support, his assistance in data gathering, and for his guidance on policy issues related to the study.

The Washington State Department of Employment Security provided us with much of the economic data. In particular, we appreciate the efforts of Frank Cole, Jeffrey Jaksich, Tim Norris, and Jim Nygaard. We also owe our thanks to the biologists who provided the data necessary to estimate fish returns and enhancement costs: Steve Parker of the Yakima Indian Nation, David Lind, and Bruce Watson. We are particularly appreciative of the work of Bruce Watson, who provided critical insight into the expected outcomes of the fishery enhancement activities.

The city and county governments and county extension agents of the study area generously donated time to our data gathering and to our assessment of fiscal impacts. A number of individuals in both private construction firms and public agencies provided data and insight into passageway screening and other enhancement construction. John Manfreddie of the U.S. Bureau of Reclamation, John Easterbrook of the Washington Department of Fisheries, William Crissman of Chelan County P.U.D., and Harry Sens were especially helpful.

We would like to thank our professional colleagues Chris Carter, M. Henry Robison, and Steven Hensen who contributed their insight to the economic modeling efforts. We are indebted to Dale Comstock, Central Washington University, Dean of Graduate Studies and Research, who guided us through many parts of the institution's bureaucratic maze.

We gratefully acknowledge the organizational talents and the commitment of Julie Guggino and the technical expertise of William Swain, Rich Willott, and Eric Phillips.

The authors are responsible for any errors.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

A variety of economic activities will result from planning, construction, operation, maintenance, assessment, and harvests associated with the Yakima/Klickitat Fishery Enhancement Program. We refer to the subject of the study as the Yakima/Klickitat Fishery Enhancement Program because our study includes the Production Project as defined in the Draft Environmental Assessment (Bonneville Power Administration, 1989), plus the limited screening and passageway improvements explained in Chapter 2. This study incorporates a wide range of data and methodologies to estimate the impact of these activities upon the economies of the project area. Chapter 1 first summarizes the background and purpose of the study and then introduces the analytical procedures that guide the organization of the report.

Backwound

The development of hydroelectric dams, irrigation systems, and navigational facilities for barge transportation has had a major impact on the anadromous fisheries of the Columbia River. To mitigate this impact the Northwest Power Planning Council, a multi-state policy-making and planning body, has designated 44,000 miles of free-flowing streams for protection from future hydropower development. In addition, the Council has initiated 80 projects to improve salmon and steelhead production and has proposed construction of several major fish hatcheries to supplement natural runs (Northwest Power Planning Council, 1988).

In its "Fish and Wildlife Program" adopted in 1982, the Council identified the Yakima and Klickitat rivers as the most promising tributaries of the Columbia for enhancement of anadromous fisheries. The two rivers are almost free of large impoundments and have supported large salmon and steelhead runs in the past. Biologists estimate that an average of 620,000 adult salmon returned to the Yakima River annually prior to 1880; however, combined runs of salmon and steelhead currently average less than 9,100 per year (Bonneville Power Administration, 1989).

The Bonneville Power Administration, the agency responsible for implementing the recommendations of the Council, has initiated a comprehensive program within the Yakima and Klickitat subbasins to improve fish passage facilities, construct screens for irrigation diversion structures, and construct a fish hatchery system to rebuild anadromous fish runs. Hatcheries will use native stocks and natural spawning and rearing techniques. Hatchery managers will outplant fry at holding and rearing ponds throughout the subbasins. This experimental program is expected to re-establish salmon and steelhead runs in many tributaries. Among other things, this approach should eliminate the congregation of fish near the hatchery intake, disperse fishing effort, maintain a broader genetic pool, and avoid some of the hazards of major epidemics. Chapter 2 provides a more complete description of hatchery facilities and operations.

The Purpose of the Analysis

The proposed Yakima and Klickitat enhancement program will have major impacts upon the economies of the project area. During the construction phase economic flows will arise from spending on materials, services, and labor. Upon completion, expenditures associated with sport and Native American harvests will cycle through the local economies. In addition to routine program operations and maintenance expenditures, a biological monitoring and experimentation program will generate employment, spending, and income. This study identifies and measures the impacts of these activities on the project area economies. It estimates both initial spending and subsequent rounds of respending, which is complicated by the need to account for interdependencies within the local economies as well as interdependencies with economies outside of the region.

As described above, the purpose of our study is to estimate the economic impacts that will result from the construction and operations of the total hatchery program. This is the objective of an impact analysis. Impact analysis, however, does not purport to weigh the economic benefits of a project against its costs. The study will generate estimations of flows and impacts of the project; estimations of net benefits are not in the purview of the analysis.

Overview of Procedures

Figure 1.1 provides an overview of the procedures used in this study. The five major activities are to develop models, gather and validate data, estimate direct impacts, estimate indirect impacts, and interpret findings. The sequence of these activities (each of which is described below) provides the organizational structure for this report.

Develop Models

This study is based on analyses of six economic models. The first four models (construction, operations and maintenance, monitoring and experimentation, and harvest) are direct impact models that convert physical and financial activities into dollar expenditures that affect each of the study counties. In the construction model, we allocate construction activities into business sectors within counties and project the extent to which the expenditures for inputs will actually be made in the target areas. Similarly, we use the operations and maintenance model, as well as the monitoring and experimentation model to project spending for sectors both inside and outside the target areas. The harvest model converts sustainable fish harvest numbers by specific locations, by species of fish, and by different types of fishers into expenditures which, in turn, will have impacts upon specific sectors and locations in the target areas. Chapter 5 provides a more complete description of these four models.

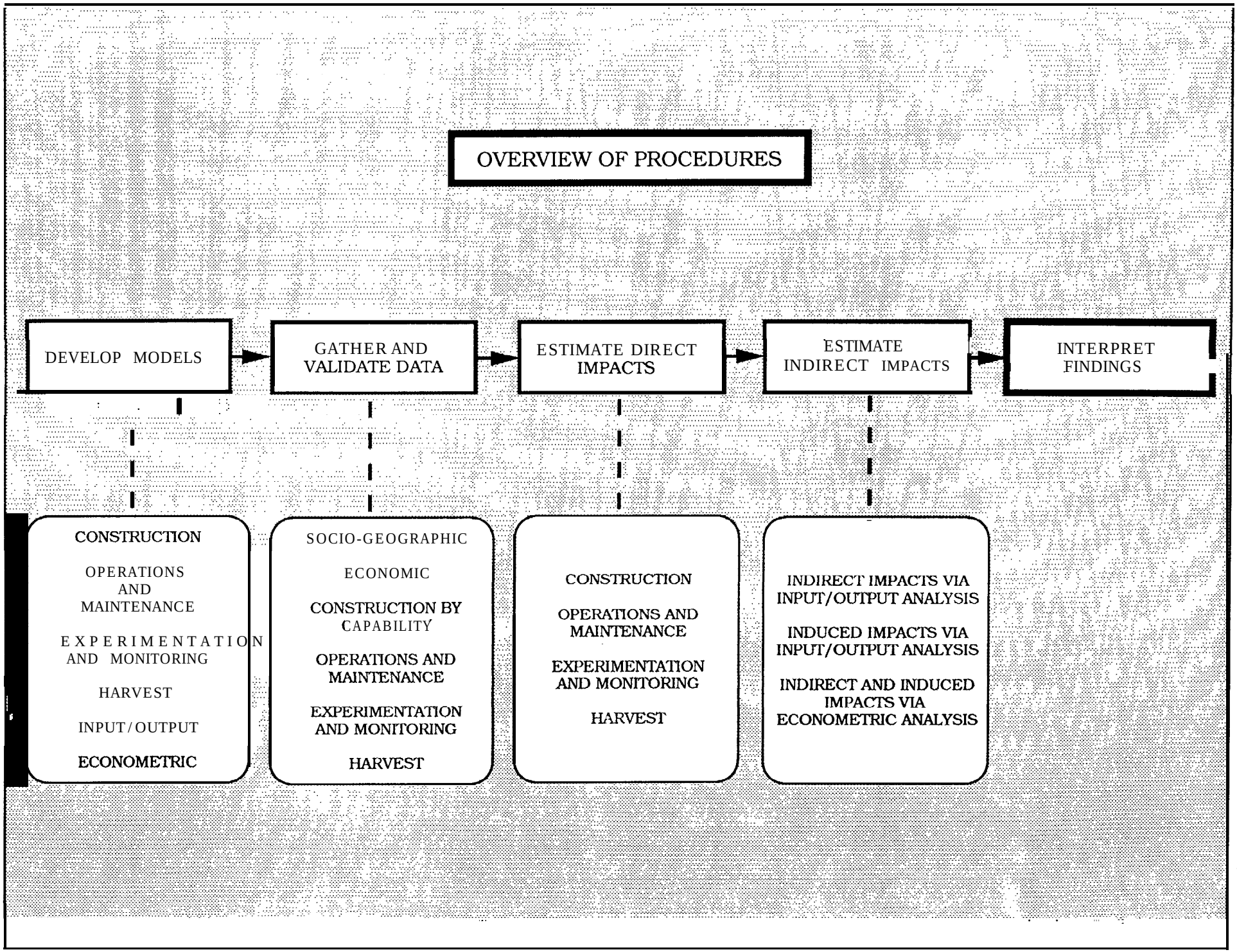

OVERVIEW OF PROCEDURES
DEVELOP MODELS
GATHER AND VALIDATE DATA
ESTIMATE DIRECT IMPACTS
ESTIMATE INDIRECT IMPACTS
INTERPRET FINDINGS
CONSTRUCTION
OPERATIONS AND MAINTENANCE
EXPERIMENTATION AND MONITORING
HARVEST
INPUT/OUTPUT
ECONOMETRIC
SOCIO-GEOGRAPHIC
ECONOMIC
CONSTRUCTION BY CAPABILITY
OPERATIONS AND MAINTENANCE
EXPERIMENTATION AND MONITORING
HARVEST
CONSTRUCTION
OPERATIONS AND MAINTENANCE
EXPERIMENTATION AND MONITORING
HARVEST
INDIRECT IMPACTS VIA INPUT/OUTPUT ANALYSIS
INDUCED IMPACTS VIA INPUT/OUTPUT ANALYSIS
INDIRECT AND INDUCED IMPACTS VIA ECONOMETRIC ANALYSIS

Figure 1.1

Each of these first four models provides estimates of direct impacts; that is, the initial purchases from the economy which result from projected expenditures. We use the remaining two models (input-output and econometric) to estimate the secondary effects upon the economy that result as direct expenditures cause additional rounds of economic activity. These two models are described in Chapter 3; their results are detailed in Chapters 6 and 7; and the interpretation of findings is in Chapter 8.

Gather and Validate Data

Data gathering and validation is a major component of the study. Chapter 2 presents social, geographic, and biological background information; it describes the region, existing fisheries, the planned hatchery system, and previous studies. Sources of the data for the four input models range from hatchery planning documents to inquiries among government agencies and contractors of similar projects. We compared and combined economic data from diverse sources to generate data bases for the input-output and econometric models. Data sources and adjustments are included in Chapters 5, 6, and 7.

Estimate Impacts

The third and fourth major activities listed in Figure 1.1 refer to the application of data to the models. The results of these applications are presented in Chapters 5, 6, and 7.

Interpret Findings

Finally, interpretation of findings is covered in Chapter 8. We compare the results obtained by the input-output and econometric models and indicate elements of complementarity Appendices provide detailed technical descriptions relating to each of the study activities.

CHAPTER 2

BACKGROUND INFORMATION

This chapter provides a description of the study region, the existing fishery, and the proposed hatchery system. It also reviews previous studies.

The Study Region

Both physical and economic attributes define the Yakima and Klickitat River Subbasin study region. The Yakima and Klickitat are separate river systems, both located in south-central Washington State (Figure 2.1). The Yakima Subbasin drains an area of about 6,000 square miles (Figure 2.2). Originating in Lake Keechelus, the Yakima flows for about 200 miles to confluence with the Columbia at Richland, Washington. The Yakima supports three hydropower facilities and 500,000 acres under irrigation. The Klickitat Subbasin drains an area of 1,350 square miles. Three-quarters of the Klickitat Subbasin is forest (Figure 2.3); therefore, irrigation use is less important than in the Yakima Subbasin.

The identification of functional economic areas depends upon the flows and interactions of economic activities. After considering trade patterns, we determined that a study region comprised of three-subareas is the most appropriate basis for economic analysis. The three functional subareas are (1) Yakima and Kittitas counties; (2) Klickitat, Wasco (Oregon), and Hood River (Oregon) counties; and (3) Benton and Franklin counties (Figure 2.1). Chapter 4 explains the economic rationale that supports these county groupings. Yakima, Franklin, and Benton counties are classified as metropolitan because of the City of Yakima and the Tri-Cities' populations. The remaining three counties are non-metropolitan. A brief description of the counties in terms of physical, social, and economic features is presented in Appendix A. The Yakima/Kittitas region will experience the greatest economic impact because of the size and type of proposed hatchery facilities in each region, the size and nature of the local economies, and the interaction of economic flows.

The Historic and Existing Fisheries

At one time the Yakima Subbasin supported large numbers of anadromous fish, most notably spring chinook and sockeye, and was one of the largest contributors to the Columbia River Basin fishery. Historic production of anadromous fish in the Yakima River has been estimated at 620,000 fish (Draft Environmental Assessment, p. 33). The Yakima now supports runs of fall chinook and summer steelhead, but summer chinook and natural coho salmon are extinct in the Yakima. Resident rainbow trout, brown trout, and cutthroat trout are also important to the people and the economies of the region.

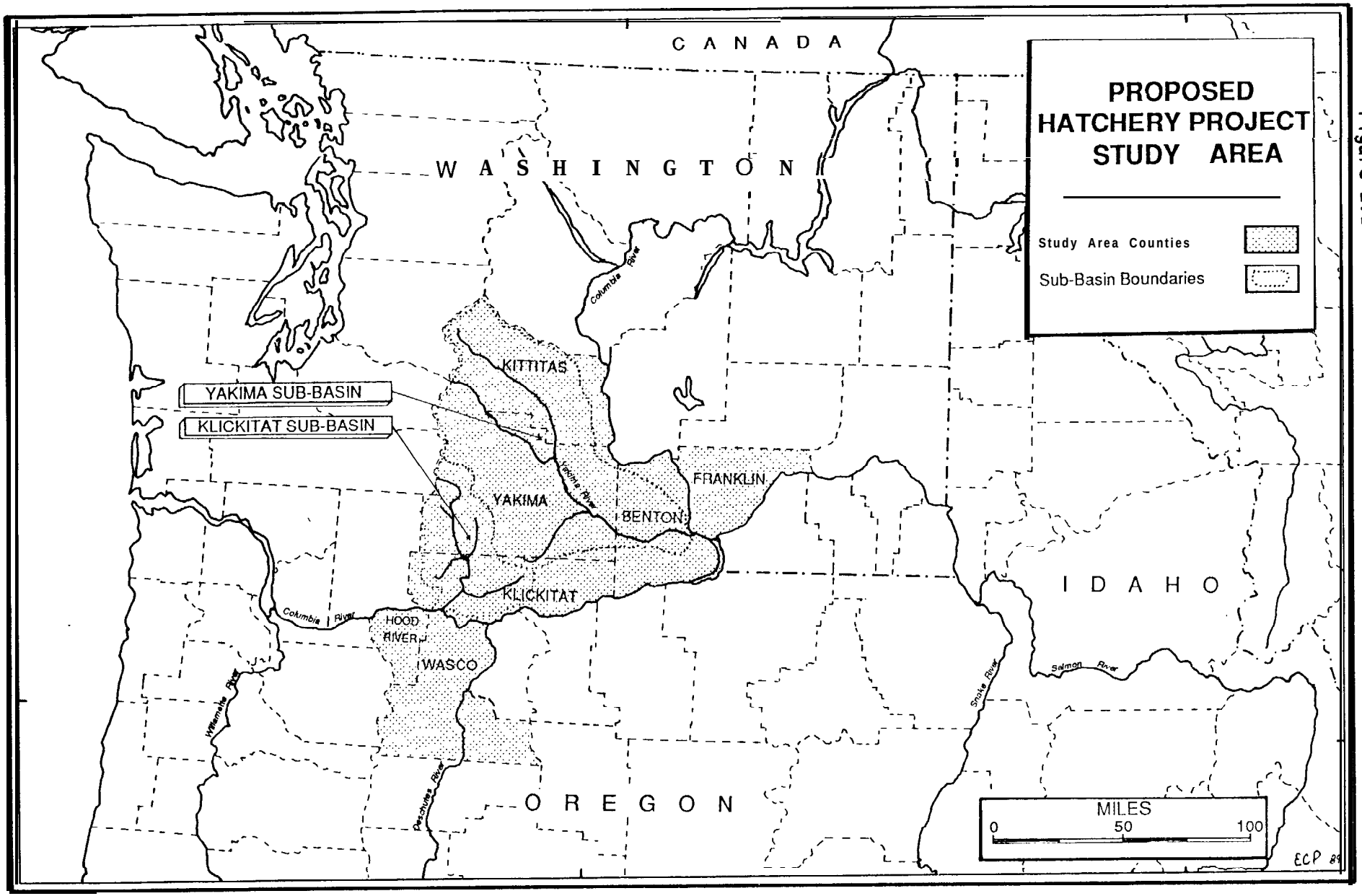
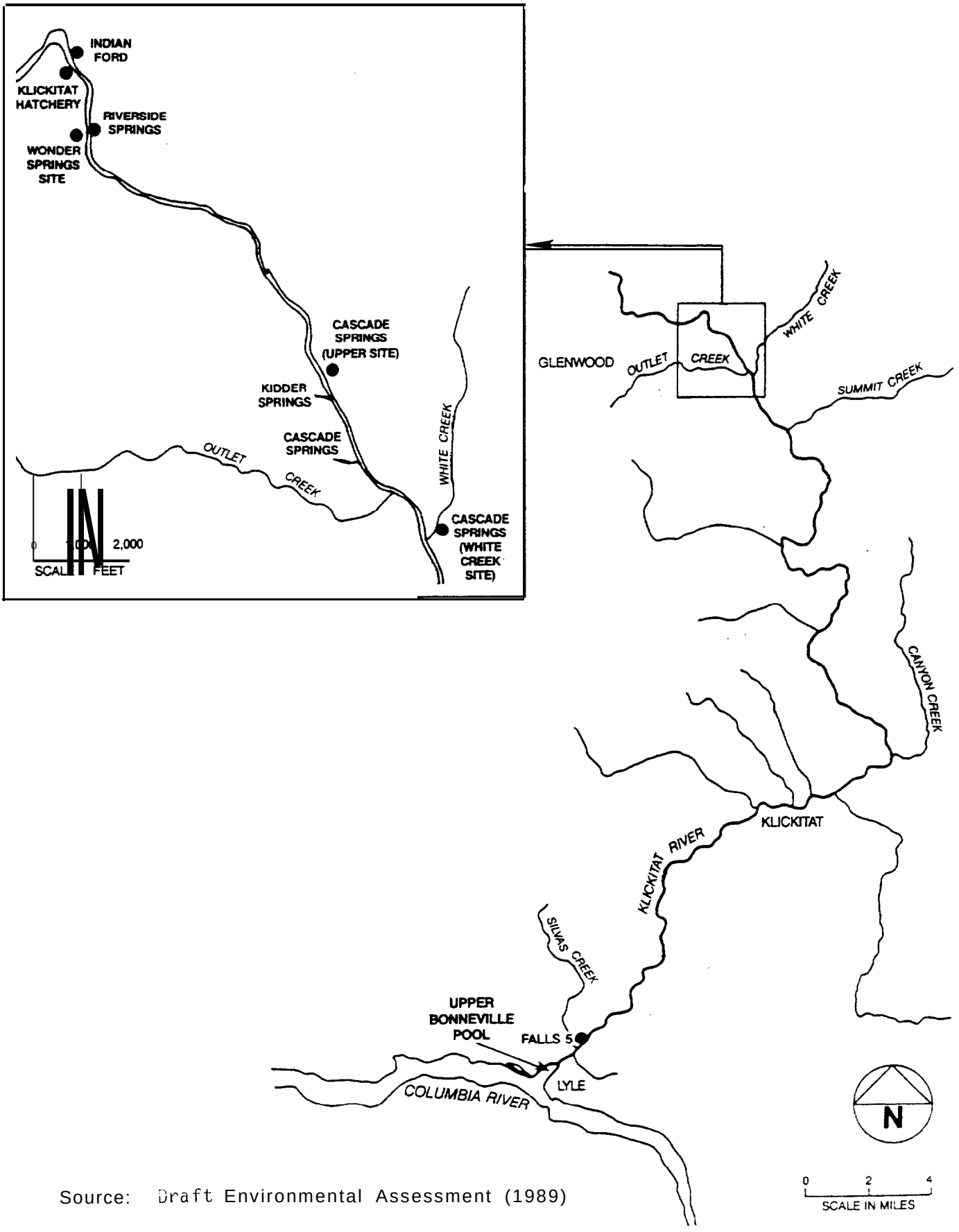

CANADA
WASHINGTON
PROPOSED
HATCHERY PROJECT
STUDY AREA
Study Area Counties
Sub-Basin Boundaries
YAKIMA SUB-BASIN
KLICKITAT SUB-BASIN
KITTITAS
YAKIMA
BENTON
FRANKLIN
KLICKITAT
HOOD RIVER
WASCO
IDAHO
OREGON
Columbia River
Yakima River
Snake River
Salmon River
Williamette River
Deschutes River
MILES
0
50
100
ECP 89

Figure 2.1

Figure 2.2 Yakima Subbasin.

Source: Draft Environmental Assessment (1989)

Figure 2.3. Klickitat Subbasin



Source: Draft Environmental Assessment (1989)

The Klickitat River was also an important component of the Columbia Basin fishery. A significant Indian fishery existed at Lyle Falls prior to 1920. Presently, a dip net fishery exists at Lyle Falls and Falls #5. Unfortunately, there is no historical evidence that provides estimates of anadromous fish numbers in the Klickitat. Spring chinook followed by summer and winter steelhead are the most numerous anadromous species currently. Resident rainbow trout exist in significant, but unknown, numbers.

Tables 2.1 and 2.2 present data on existing fisheries and proposed augmentation in the Yakima and Klickitat subbasins. The information in these tables is based on the subbasin plans. A more detailed narrative of each subbasin's fishery is included in Appendix B.

Description of Planned Hatchery and Outplanting Facilities

The primary objective of the planned anadromous fish enhancement facilities in the Yakima and Klickitat subbasins is to protect and supplement wild stocks of salmon and steelhead in the region. More specifically, three categories of objectives comprise the basis for the project: productivity enhancement, stock status enhancement, and experimental goals (Master Plan, FMC 1987). Productivity enhancement will increase production of each stock to its maximum sustainable yield. Stock status enhancement will improve the stock status of salmonid stocks in the subbasins through supplementation. Experimentation and monitoring will reduce uncertainties regarding supplementation methods (Environmental Assessment, 1989). The experimental objective is conceptually tied to the production and supplementation objectives by means of a policy of adaptive management. Therefore, management strategy will be altered in response to feedback from the monitoring, evaluation, and experimentation processes.

Tables 2.1 and 2.2 outline production plans by species in the Yakima and Klickitat subbasins. The fish enhancement facilities will markedly augment existing runs of spring chinook, fall chinook, and summer steelhead in the Yakima Subbasin and will establish summer chinook and coho. In the Klickitat Subbasin existing runs of spring chinook and summer steelhead will increase significantly.

The master plan for the program (FMC, 1987) details the relevant conceptual design, management techniques, production profiles, experimental programs, and potential sites. Central outplanting facilities will be capable of handling activities such as incubation and rearing. Minimum capital satellite facilities will be used for egg incubation, early rearing, partial smolt rearing, acclimation, and/or release. Already existing facilities will be used for adult trapping although some trapping for selected broodstock will occur at other locations (Master Plan, p. 15). Net pen sites will consist of portable rearing pens accessible by boat or from a structure such as a dock. Finally, acclimation sites will be used for short terms prior to release.

Table 2.1. Yakima Subbasin Production Plans[a]

Species	Escapement to Subbasin	Sustainable Terminal Harvest	Terminal Harvest Rate	Total Harvest to All Fisheries	Natural Spawning Escapement
Spring Chinook					
Existing[b]	4,910	1,424	.29	2,539	2,789
Enhanced[b]	21,498	12,467	.58	17,250	7,225
Net Increase	16,588	11,043	(.29)	14,711	4,436
Summer Steelhead[c]					
Existing[d]	4,107	780	.19	1,605	2,994
Enhanced[d]	22,961	11,251	.49	15,863	10,539
Net Increase	18,854	10,471	(.30)	14,258	7,545
Fall Chinook					
Existing[e]	3,304	628	.19	13,827	2,409
Enhanced[e]	7,839	4,390	.56	35,723	3,106
Net Increase[e]	4,535	3,762	(.37)	21,896	697
Summer Chinook[f]					
Existing[g]	0	0	0	0	0
Enhanced[h]	7,977	4,866	.61	7,781	2,489
Net Increase	7,977	4,866	(.61)	7,781	2,489
Coho[f]					
Existing[g]	0	0	0	0	0
Enhanced	6,151	3,260	.53	17,431	6
Net Increase	6,151	3,260	(.53)	17,431	6

[a]Based on "Yakima Subbasin Plan" and "Refined Statement of Goals Yakima/Klickitat Production Project."

[b]"Enhancement" of spring chinook includes the following strategies (modified slightly from "Yakima River Subbasin, Salmon and Steelhead Plan," June 20, 1989, Draft) : Strategy 1: implementation of YKPP with existing habitat; Strategy 2: Strategy 1 plus additional habitats described in Table 1; Strategy 3: Strategy 2 plus halving open-river smolt losses; Strategy 4: Strategy 3 plus rebuilding Phase-II screens; and Strategy 5: Strategy 4 plus off-channel winter refuges.

[c]It has been assumed that it will ultimately be decided that YKPP steelhead will be outplanted above Roza Dam. This issue is currently being debated.

[d]"Enhancement" for steelhead includes the same measures listed for spring chinook.

[e]"Enhancement" for fall chinook includes the following strategies (modified from Draft Yakima Subbasin Plan): Strategy 1: implementation of YKPP

Table 2.1. (Con'd)

with existing habitat; Strategy 2: Strategy 1 plus halving open-river smolt losses; and Strategy 3: Strategy 2 plus increasing zero-density egg-to-smolt survival to 0.50. Note that new information leads to the decision to drop Strategy 4--the addition of new production area (Wanity Slough, Drain 4 and lower Toppenish Creek) to Strategy 3.

[f] For fall chinook and coho, estimates are that 80 percent or more of these species will be harvested before they reach the Yakima River.

[g] For planning purposes, "hypothetical existing" figures are used, but they serve no purpose here.

[h] "Enhancement" of summer chinook includes the following strategies (taken from the Yakima Subbasin Plan): Strategy 1: implementation of YKPP with existing habitat; Strategy 2: Strategy 1 plus halving open-river smolt losses; and Strategy 3: Strategy 2 plus renovating all Phase-II screens.

[i] "Enhancement" of coho includes the following strategies (taken from the Yakima Subbasin Plan): Strategy 1: implementation of YKPP with existing habitat; Strategy 2: Strategy 1 plus halving open-river smolt losses; and Strategy 3: Strategy 2 plus renovating Phase-II screens.

Table 2.2. Klickitat Subbasin Production Plans[a]--Run Sizes and Harvest Rates under MSY Conditions

Species	Escapement to Subbasin	Sustainable Terminal Harvest	Terminal Harvest Rate[b]	Total Harvest to All Fisheries	Natural Spawning Escapement[c]
Spring Chinook					
Enhanced[e]	3,899	1,170	0.30 0.85	1,663	71[d]
Existing	21,238	18,052		20,880	286
Net Increase	17,349	16,892	(0.55)	19,217	215
Summer Steelhead					
Enhanced[e]	5,574	3,344	0.70 0.60	3,940	2,220
Existing	11,726	8,208		9,461	6,977
Net Increase	6,152	4,864	(0.10)	5,521	4,748

[a]Based on simulation model runs presented in the Klickitat Subbasin Plan; improvements in juvenile passage at Bonneville Dam are assumed.

[b]MSY rate; current harvest plan specifies lower rate until runs are rebuilt.

'Natural escapements predicted to be sufficient by simulation model are lower than currently agreed-upon interim escapement goals.

[d]Average from spawning ground counts 1977-87; model predicts a higher number.

[e]Improvements in Castile Falls facilities allowing adult passage.

The Master Plan analysis recommends the group of facilities described in Alternative 1 (Tables 19 and 20, pp. 48 and 51 of the Master Plan). The construction cost estimates for this analysis are based on Alternative 1, which includes the development of central facilities at the Thorp site near Ellensburg, a smaller central facility for production of steelhead and fall chinook at Buckskin, and a facility for production of spring chinook and summer steelhead at Cascade Springs on the Klickitat River (Master Plan, p. 77). The development of these facilities would incorporate satellite rearing stations at the Old Yakima Intake (Naches River), Prosser, Wapato, and Wonder Springs. (The Wapato site was decided on as a substitute for the Sunnyside site after the printing of the Master Plan and is the preferred site for Alternative 1.) Portable raceways would be used as acclimation sites. At the time of this report, a Cle Elum site is under consideration as a substitute for the Thorp site. This substitution will make little difference in the economic analysis, which is conducted at a county level of aggregation.

Development of these sites into an integrated fish propagation system will require several additional activities which are not specifically included in the Master Plan but must be included in this study because of their related function. These production activities include further habitat enhancement by means of ladders, screening, and water supplementation; reduction of smolt losses; Phase II screening; and development of acclimation sites and off-channel water refuges. Harvest estimates used for this study are based upon the assumption that these activities will be included. In the remainder of this report, all these activities will be referred to as "enhancement."

For the economic analyses, we divided the program into four major elements: construction, operation and maintenance, experimentation and monitoring, and harvest. Each of these elements and their subset activities have their own timelines. The subset activities for construction expenditures as well as operations and maintenance expenditures are separated into categories of (1) "hatchery," which includes all sites listed in the master plan plus acclimation sites; (2) "Phase II, which includes screening activities in the Yakima Subbasin; and (3) "enhancement," which encompasses a program of adding tributaries. This program is detailed in Appendix C. Because of the nature of required activities, reduction of smolt losses Is incorporated into experimentation and monitoring.

The input-output analysis is based on detailed models of two "slices" of activity: (1) an average year during which construction and experimentation occur and (2) a typical year of maximum sustained yield in which fish are being harvested and experimentation and operations and maintenance activities are taking place. The econometric section is based upon more time-dynamic considerations. It views the impacts across a twenty-five-year continuum and considers changes on a quarterly basis. Throughout the study we developed detailed models of the typical construction and harvest years for use as an input into the input-output model. For the econometric model we have developed broader, less detailed measures for multiple time periods.

Prior Related Studies

We completed a comprehensive bibliographic search of related studies early in the project. The resulting one hundred-entry bibliography is included as Appendix 0. Because of the unique nature of the hatchery project, no completely parallel studies were available. The elements which make this project unique are the combination of the experimental goal, the use of adaptive management techniques, the incorporation of expenditures by Native American fishers, and the magnitude of the change in planned runs. The small size of the economic impact area, although not unique, is unusual: most studies concern state or a multi-state impact areas. Nevertheless, we found useful parallels for many aspects of this study.

The use of input-output analysis has become a common means of estimating the impacts of fisheries management policies. This is due, at least in part, to the recent availability of "top-down" models that estimate local data and parameters from national models. The options range from prepackaged software to models developed by private firms and government agencies under special contract. All of these options are usually based upon the use of data derived from the national model. Another option is a hybrid model which uses primary inputs for most data but national coefficients for the production function. IMPLAN, the model that we used, can be applied in either the prepackaged or the hybrid mode. A product of the U.S. Forest Service, it is used frequently in fishery applications, and a considerable literature is being developed on its modification and use for evaluating management alternatives (see Radtke).

Previous economic impact work in the study region provides some basis for comparing the results of this model. These studies are

1. The Yakima Basin Targeted Industries Study by Burcher, Willis, and Ratliff, which includes a RIMS II input-output model detailing multipliers for sectors of the Yakima County economy

2. A study of the "Economic and Community Impacts of Closing Hanford's N Reactor and Nuclear Materials Production Facilities" by Battelle Northwest Laboratory, which includes multipliers derived from two models--an input-output model based upon Phillip Borque's transactions tables for Washington State and the WASHMOD econometric model (Scott, et. al., 1987)

3. A study of "Tourism in the Columbia Gorge," which includes multipliers derived from an IMPLAN model of Klickitat, Hood River, Skamania, and Wasco counties (Morris and Anderson, 1988)

In terms of direct impacts, we know of no other studies that attempt to evaluate expenditures similar to those associated with the experimental goals of the Yakima/Klickitat project. Yet, the input-output format makes such application a relatively straightforward matter once the expenditures have been estimated. Similarly, operations and maintenance can be readily evaluated.

Concerning measures of expenditures arising from recreational fishing, we found three studies particularly useful: "Net Economic Value of Recreational Steelhead Fishing in Idaho," by Donnelly, et. al., 1985; the Oregon State Department of Fish and Wildlife study, "Survey and Economic Impact Analysis of the 1988 Willamette Run Spring Chinook Sports Fishery," by The Research Group; and the Oregon State Department of Fish and Wildlife's annual publication, "The 1987 Lower Columbia River (Bonneville to Astoria) and Estuary Salmon (Buoy 10) Recreational Fisheries," by Hess and King, 1988. We used these as sources of information for our preliminary IMPLAN runs, and they were also be used to refine our IMPLAN data inputs for the final report.

The assessment of direct impacts stemming from harvest is discussed extensively in the literature; however, there is considerable controversy over conceptual and empirical matters. Some major aspects of the harvest expenditure assessment, such as Native American fishing impacts, are not, to our knowledge, treated in the literature. Similarly, most fishery evaluations consider only the impact of existing fisheries or of small marginal changes to existing fisheries. There are few studies that evaluate massive increases in the size of fish runs. Overall, we have found no studies which closely parallel the modeling needs of this project.

CHAPTER 3

ECONOMIC METHODOLOGIES

Impact analysis is commonly used in regional policy making to predict the positive economic changes that result from a project. These changes, or impacts, are experienced as increases or decreases in the magnitude of selected economic variables; employment, output, income, value added, and taxable sales are the most often used impact variables, Project impacts may be estimated for a local, regional, state, or national economy.

The purpose of this study is to estimate the positive impacts of the fishery enhancement project upon the immediate regional economy. This chapter explains two complementary methods, input/output analysis and econometric modeling, that we will use to estimate total regional impacts that result from the initial direct effects of the fishery enhancement project. First we describe the general types of economic impacts. Then we briefly explain input/output and regional econometric modeling and the relationship between these two complementary approaches.

Types of Economic Impact

There are three types of economic impacts, direct, indirect, and induced--each of which captures one facet of change in regional economic activities.

Direct Impacts

Direct impacts refer to the initial purchases within an economy that result from project activities. Direct impacts of the fishery enhancement project include expenditures stemming from construction, operations and maintenance, experimental and monitoring programs, and from harvest activities by recreational and Native American fishers. Examples include purchases of concrete for hatchery construction, purchases of tackle and equipment for harvesting, and expenditures for lodging by out-of-area experimental consultants.

Indirect Impacts

The production and sales of goods and services that result in direct impacts require inputs from other business sectors. For example, in order to sell fishing tackle and equipment at the retail level (a direct impact), materials will be purchased from wholesalers and manufacturers. This second level of activity is the source of indirect impacts.

Induced Impacts

The changes in employment in those industries that experience both direct and indirect impacts result in changes in income that are spent in the

region to purchase consumer goods and services. This income effect is the source of induced impacts. For example, if additional tackle is produced locally, local incomes will increase. Local spending of this additional income is the basis of an induced impact.

Total Economic Impact

The total economic impact is found by adding all three levels of impact for each sector of the local economy. The larger the magnitude of local purchases, the larger will be the total local impact; conversely, the larger the portion of expenditures which are made outside the local economy, the smaller will be the total local impact. The amount spent outside the region does not effect the local economy, but the amount spent locally on such things as concrete, services, and supplies is considered a local impact. Similarly, purchases resulting from increased wages which stem from both direct and indirect impacts are the basis for the induced impact, a further round of local spending. Induced impacts lead to additional rounds of indirect and induced impacts.

To the extent that expenditures occur outside the local economy, they are considered to be leakages. With each round of spending a portion usually leaks outside the local economy. Leakages from successive rounds of spending eventually taper further rounds of respending to zero. The larger the region, the more intricate the economic linkages and, accordingly, the greater the total local impact from a given direct expenditure.

There is, therefore, a multiplicative effect of a given direct impact, which results in greater total impacts. This so-called multiplier reflects tne extent to which the initial expenditures recirculate through a local economy. The multiplier shows the relationship of direct impact to total impact and depends upon both the degree of linkages among the local industries and the extent of leakages. In a general sense, the multiplier can be estimated by dividing the total impact by the direct impact. For example, if a total impact of $1000 is comprised of $500 of direct impacts, $275 of indirect impacts, and $225 of induced impacts, the multiplier is $1000/$500 or 2. In this example, each dollar of direct impact creates a total impact of $2. Note that the total impact includes the original dollar of direct impact. To most accurately assess the multiplicative effect, estimates of the multiplier are often derived for each sector of the economy. To accomplish this task a computer model of the local economy can simulate local economic interactions. The two most common types of models are the input-output model and the econometric model.

Input-Output Models

An input-output (I/0) model simulates the economic relationships of an economy. These relationships, or linkages, are measured by the dollar value of purchases or sales among the various industrial and commercial sectors. Thus the model links the microeconomics of diverse businesses to the macroeconomics of the local economy. Economists have used I/0 analysis for fifty years to evaluate changes in inter-industry flows of goods and services and resulting changes in output, employment, and income. I/0

models are composed of three parts: an inter-industry flow table, a technical coefficients matrix, and an interdependence coefficients matrix. A mathematical specification of the I/O model is presented in Appendix E.

The I/O model is based upon a specification of production relationships within an economy; such a specification shows the magnitude of each industry's purchases from other industries. These production relationships are combined with measures (regional purchase coefficients) that reflect the extent of local purchases in each input category. The resulting matrix is the direct requirements table, Any direct expenditure can be multiplied by the coefficient of the affected industry to find the first round of indirect effects. In turn, this first round will generate other rounds of indirect effects that can be determined in a similar manner to direct effects. Subsequent rounds of indirect spending eventually become negligible for the various categories, which allows for a determination of total indirect impact. A similar iterative process using household incomes provides an estimate of induced effects. Totals of direct, indirect, and induced effects enable calculation of a multiplier.

The primary strength of the I/O model is its level of detail, which allows for estimates of industry-specific impacts. Its weaknesses are its static nature and the degree of detail required for the input data. Despite its static nature, this "snapshot of the economy" can be used as baseline for projections, as long as the production relationships do not change over the period of projection. Although numerous dynamic I/O models were constructed in the 1960s and early 1970s, the relatively constant nature of most production relationships showed the data and modeling requirements of the dynamic models to be redundant with respect to practical applications. Advances in deriving regional models from national relationships have markedly reduced the amount of primary data that needs to be gathered.

There are several non-survey models and modeling services available when time and financial constraints preclude obtaining full survey data. The models are relatively inexpensive and are considered to be reasonably accurate. (For a comparison of commonly used models see Bruckner, Hastings, and Latham, 1987.) One widely used non-survey model is the U.S. Forest Service IMPLAN (IMpact analysis for PLANning) model, which adapts a national input-output table to the local economy by using national production coefficients and local levels of sectorial employment and final demand. IMPLAN includes a data base of information from secondary sources and a software program that enables calculation of regional models down to the size of individual counties. After consideration of the advantages and shortcomings of a number of non-survey I/O models, we decided to use a modified version of IMPLAN.

The IMPLAN data base includes a national matrix of technical coefficients and estimates of sectorial vectors for final demand, final payments, gross output, and employment. There are 528 industry sectors in the current version, which is based upon the 1985 national model and business census.

We adjusted the data supplied by the IMPLAN model in order to increase the accuracy of application. In general these adjustments included revising employment agricultural output industrial output, and total value added data.

The employment data we used were obtained from the Washington State Department of Employment Security. The data were provided in unsuppressed form for 1987 at the four-digit SIC level of specificity. Employment Security data were used for each of the Washington counties in the model area, while comparable Oregon county data are based upon the IMPLAN data set.

Agricultural output and employment data were collected from a variety of sources including Washington State Employment Security, Washington State Agricultural Statistics, the Census of Agriculture, the Bureau of Reclamation Crop Reports, and interviews with local Extension agents in each county. Agricultural output data were adjusted to the same year as the employment data (1987). Industrial output data were adjusted to maintain the employment/output ratios of the original IMPLAN data. Employee compensation and proprietary income were obtained from the U.S. Department of Commerce and were also adjusted to maintain the total value added/output ratios of the original IMPLAN data.[l]

IMPLAN generates a number of reports that describe the structure of the local economy. These include output, employment, and income multipliers (Types I and III) and a fully disaggregated Leontief inverse based upon an industry convention similar to the U.S. Department of Commerce, Bureau of Economic Analysis national input-output model. Rather than use multipliers derived from summing the columns of the Leontief inverse, we used multipliers based upon a spreadsheet that incorporates all of the columns of the Leontief inverse of industries that are impacted in any way by the project.[2]

Econometric Model

The term "econometric model" encompasses a wide variety of methodologies used by economists to estimate economic relationships. For this study, we used a regional econometric model to quantify the key linkages between employment, income, and spending in a region. We estimated the magnitude and extent of these linkages by using historical data on the operation of the regional economy. Once estimated, the model can be used to simulate the changes in the regional economy that arise from the fishery enhancement project. This is accomplished by first creating a baseline model which predicts the annual activity levels of the economy for each year of a specified period. In this simulation the period begins In 1990 and continues through 2015. Next the model is re-run to include the direct impacts of the fishery enhancement project. The differences in employment, income, and taxable sales which arise between these models are attributable to the project.

Most important, the econometric analysis complements input/output analysis by the incorporation of time-dynamics. When a direct impact occurs, the full economic impact is not felt immediately throughout the local economy. Since indirect and induced impacts result form the recirculation of spending, time is required for the direct impacts to work through the economy. The econometric analysis provides for this time element and estimates the time lag required for the multiplier effect to begin, peak, and decline. On the other hand, input/output analysis is static and

portrays an instantaneous conversion of direct to indirect and induced expenditures. This absence of dynamics in input/output is the shortcoming which makes econometric analysis a useful complement. The remainder of this section describes the econometric model, its use in estimating the economic impacts of the fishery enhancement project, and its complementarities and contrasts to the input-output approach presented earlier.

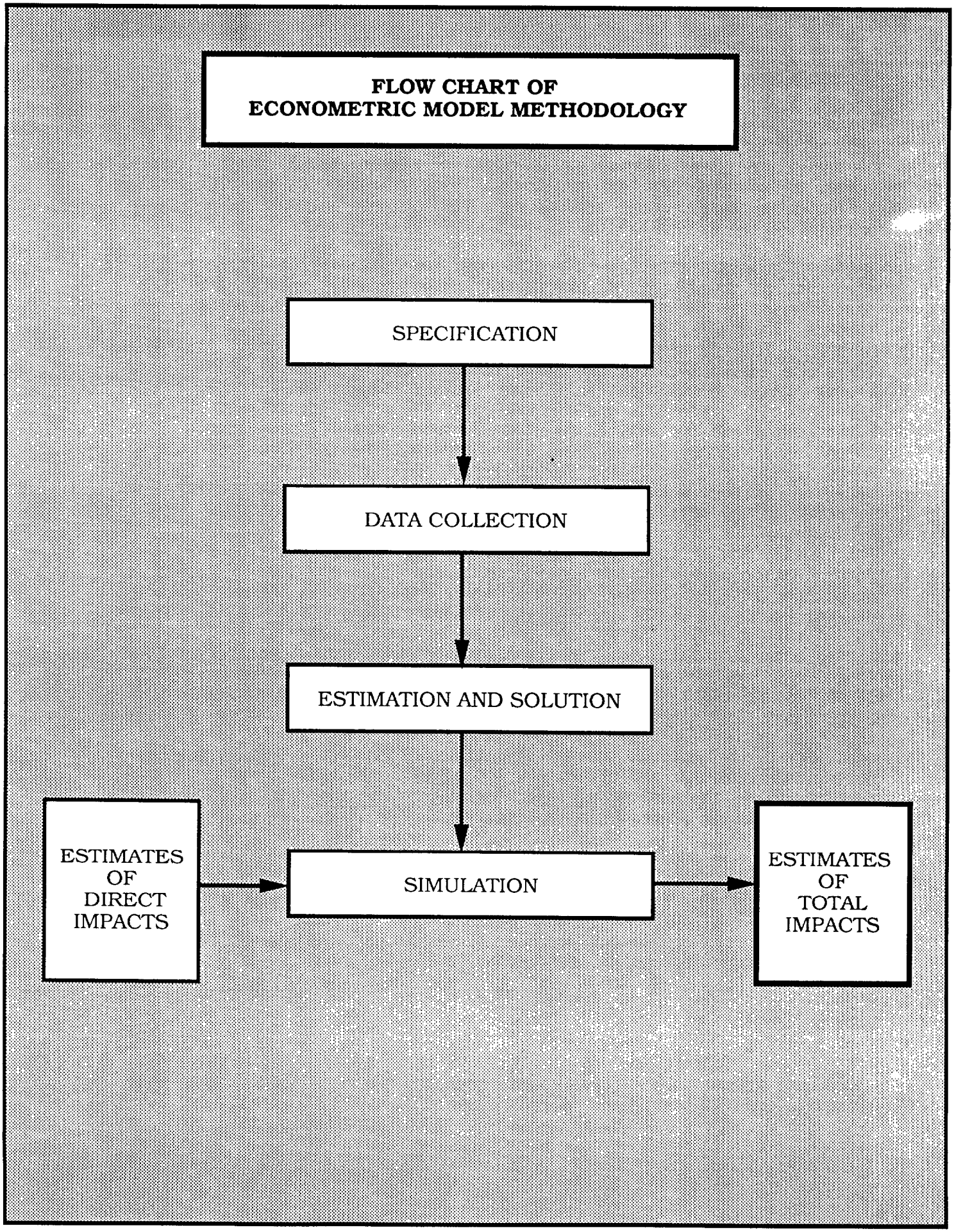
Outline of the Econometric Model Methodology

A flowchart of the methodology of the econometric model is given in Figure 3.1. The methodology is broken down into four discrete steps. First, the key economic variables and their interactions are specified. Second, time-series data are collected on the economic variables included in the specified model. Third, the economic relationships of the model are estimated using the appropriate statistical techniques. The model is then solved using the past values of the variables to allow comparison of the actual with the predicted values generated by the model. The predictive capacity of the model is used to judge the values of alternate model specifications. Fourth, to estimate the total impacts, the model is simulated both with and without the direct impacts of the proposed fishery enhancement project. The net impact of the project is represented by the difference between the "without project" and "with project" simulations. The specification, data, estimations and solution, and simulation of the model are discussed briefly below. An in-depth explanation of these steps Is given in Appendix F.

Model Specification

Model specification in regional econometric modeling builds on the work of Glickman (1971); Hall and Licari (1974); Latham, Lewis, and Landon (1979); Taylor (1982); and Henson and Merrifield (1987). In contrast to the detailed and disaggregated input-output model, the econometric model used in this research is a highly aggregated reduced-form model of regional economic activity. It focuses on the simultaneous determination of employment and income in the regional economy, using an export-base approach.

The export-base breaks regional economic activity into two sectors: basic and non-basic. The basic sector contains those industries whose output is prlmarily exported from the region. Activity in the basic sector is assumed to be driven by economic and demographic conditions external to the region. Examples of basic activity are agriculture and manufacturing. The non-basic sector is the sum of those economic activities whose output is consumed within the region and whose demand, therefore, depends on the levels of regional economic activity. Examples of non-basic activities are retai 1 trade and services.


FLOW CHART OF
ECONOMETRIC MODEL METHODOLOGY
SPECIFICATION
DATA COLLECTION
ESTIMATION AND SOLUTION
ESTIMATES OF DIRECT IMPACTS
SIMULATION
ESTIMATES OF TOTAL IMPACTS

A simplified flow chart of the model used in this study is given in Figure 3.2. Economic variables are noted in boxes. Causal relationships between variables are indicated by arrows. Economic variables are either determined outside the region (exogenous) or within the region (endogenous). The endogenous variables are represented by sharp-cornered boxes, and the rounded-cornered boxes depict exogenous variables. We used an employment based model because data limitations restrict the accurate measurement of economic activity in the different sectors.

Regional economic activity is broken down into six different sectors: agriculture, government, manufacturing, retail trade, service, and miscellaneous. The miscellaneous sector is the sum of construction; finance, insurance, and real estate; mining (Mining in the region is primarily for crushed rock and other construction related uses. It is therefore included in the non-basic sector along with construction.); transportation, communication, and utilities; and wholesale trade. The agriculture, government, and manufacturing sectors together make up the basic sector and are assumed to be determined primarily by economic conditions external to the region. As indicated by the arrow connecting miscellaneous and manufacturing employment, allowance is made for possible backward linkages between the two sectors. The non-basic sector is composed of the retail trade, service, and miscellaneous sectors.

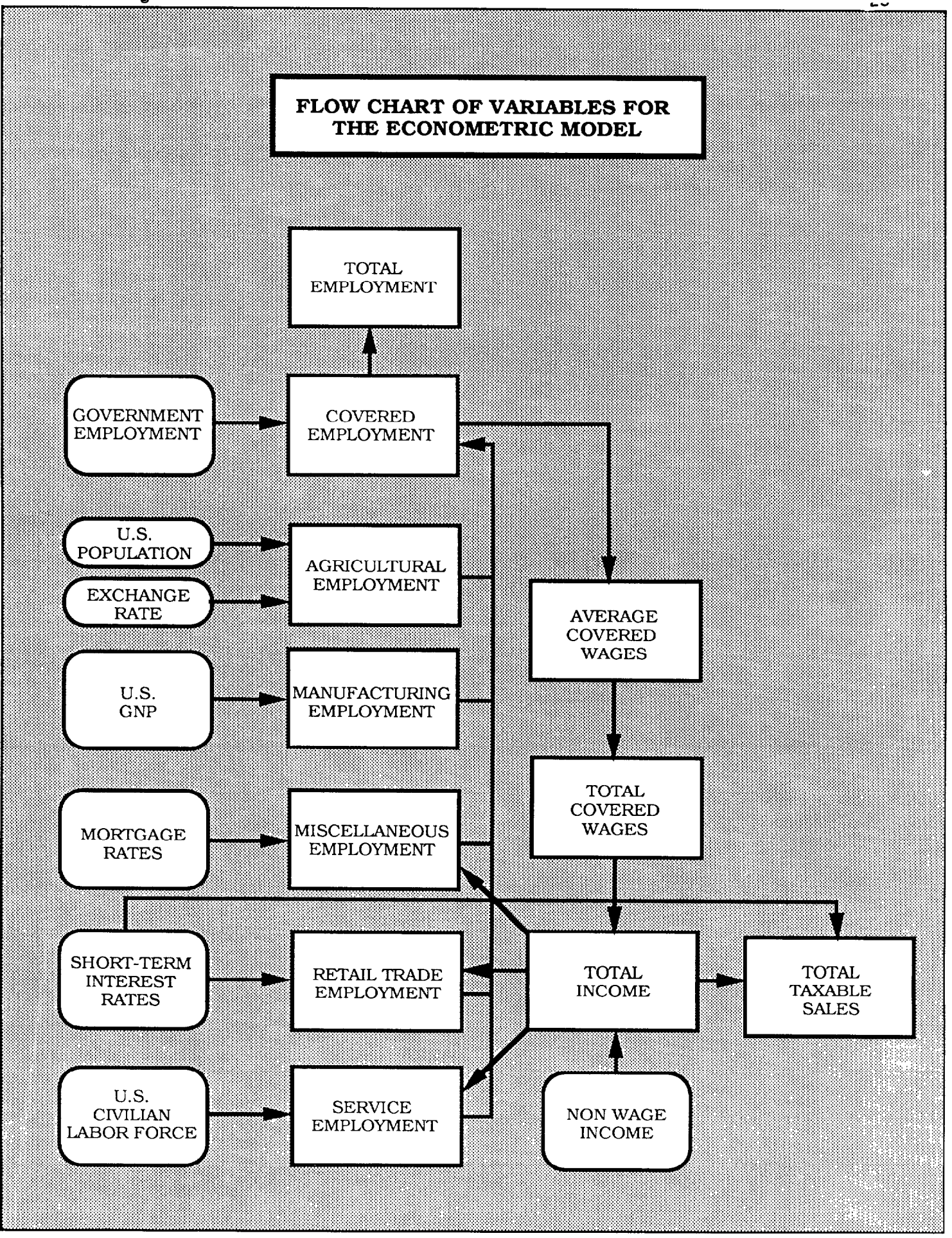
The causal flow of the model depicts the simultaneous nature of the determination of employment and income in the local economy. Economic conditions external to the region generate employment in the agriculture and manufacturing sectors. Since government activity is determined by the political process, it is assumed to be determined independently of internal and external economic considerations. Government employment is therefore added to private base-sector employment. Employment in the base sector generates additional employment and wages, which, when combined with exogenously determined non-wage income, determine income. Income derived from base sector employment and non-wage income is assumed to generate employment and income in the non-basic sector. This, in turn, generates subsequent rounds of employment and income in the non-basic sector, which continue until the additional injections of income are eliminated through spending leakages on regional imports.

Data limitations impose one further important constraint on model specification. In the model, employment in the different sectors is linked directly to income rather than to spending; data on regional expenditure patterns are limited to only those sales subject to state sales tax. For this reason, total taxable sales are assumed to be determined directly by income and economic conditions external to the region.

Data Collection

The data used in this analysis are (1) quarterly measures of employment, wages, and income in the three-county area and (2) measures which portray economic conditions external to the region from 1977, first quarter, to 1986, third quarter. These measures include national population, gross national product, index of hourly earnings, mortgage rates, and Treasury bill rates. Complete descriptions of all the variables used in the model

Figure 3.2


FLOW CHART OF VARIABLES FOR THE ECONOMETRIC MODEL
TOTAL EMPLOYMENT
GOVERNMENT EMPLOYMENT
COVERED EMPLOYMENT
U.S. POPULATION
EXCHANGE RATE
AGRICULTURAL EMPLOYMENT
AVERAGE COVERED WAGES
U.S. GNP
MANUFACTURING EMPLOYMENT
TOTAL COVERED WAGES
MORTGAGE RATES
MISCELLANEOUS EMPLOYMENT
SHORT-TERM INTEREST RATES
RETAIL TRADE EMPLOYMENT
TOTAL INCOME
TOTAL TAXABLE SALES
U.S. CIVILIAN LABOR FORCE
SERVICE EMPLOYMENT
NON WAGE INCOME

and their means and standard deviation are given in Appendix F. Data to support specification and estimation of the regional econometric models are relatively limited. Consistent time-series regional data are likewise not available for output and expenditures in different sectors. Data are therefore confined to employment, wage, and income. Employment and wage data, because of the frequency of its collection and the availability of a relatively long time-series, are the most useful.

The employment and wage data used in this study are from Washington State's Department of Employment Security. Covered employment includes employees covered by the state's disability and unemployment insurance programs. Covered employment and wage data are collected monthly and released to the public quarterly in the Employment Security's "Employment and Payrolls in Washington State by County and Industry." The employment data are aggregated under major sectorial headings consistent with the model.

To calculate regional unemployment rates, Employment Security estimates total employment and the civilian labor force in each county. These total employment data are used to adjust covered employment generated by the model upwards to better reflect actual employment in the region. Adjustment of covered employment to estimate total employment is discussed further in Appendix F.

Since data on regional income are only available on an annual basis, income is proxied by covered wages adjusted for non-wage income to area residents. The data on non-wage income are provided by the U.S. Department of Commerce, Bureau of Economic Analysis. Inclusion of the non-wage component is especially important because the percentage of non-wage to personal income has increased from 28% in 1978 to over 34% in 1986.

Data on total taxable sales are supplied by the Washington State Department of Revenue. Total taxable sales measures only those sales subject to state sales tax. Since the sales tax is levied only on final goods and services, the majority of the sales are retail sales.

Measures of economic conditions external to the region are used to proxy the demand conditions for the output of export-base sector and outside constraints on non-basic sector activity. The measures used are U.S. population, U.S. real gross national product, U.S. index of hourly earnings, the mortgage rate, and the three-month Treasury bill rate. The measures were taken from various issues of the Washington State Department of Revenue's "Economic and Revenue Forecasts."

Estimation and Solution of the Model

The model is estimated using least-squares regression techniques. Since the sectors comprising the non-basic sector and the manufacturing sector are a block of simultaneous equations, these relationships are estimated using two-stage least squares. The remaining relationships are recursive and estimated using ordinary least squares. As measured by r^2s and F-statistics the model fits the data well. In addition, significant estimated coefficients are of expected sign and their magnitude is consistent with studies in similar areas.

The model is solved over the period, 1978, second quarter, through 1986, third quarter. The predictive errors of the various endogenous variables in the model over the sample periods are within reasonable limits. On average over the period, the predictive values of all endogenous variables fall within 2% of their actual values.

Model Simulation

To estimate the economic impacts of the proposed fishery enhancement project, the econometric model is simulated with and without the direct impacts of the project. In the econometric model, increases in base sector activity are analogous to the effects of direct impacts. The total impacts of changes in any base sector activity can be broken down into direct impacts and the sum of indirect and induced impacts. The direct impacts mark the initial change in base sector activity. The indirect impacts measure the backward linkages from the non-basic sector to the base sector. The induced impacts measure additional employment, income, and sales attributable to the recirculation of income through the individual sectors comprising the non-basic sector.

The first step in simulating the model was to create a base line model for the years 1990 through 2015. The base line model simulates the levels of employment, income, and sales in the regional economy without the fishery enhancement project. For simplicity, we assumed the economic conditions external to the region would remain constant over time.

The second step was to re-run the model, including the direct impacts of the project. Since the model is employment-based, the direct impacts estimated in Chapter 5 were first converted into direct employment impacts. These direct employment impacts were entered into the model as they occur during the simulation period.

The third step involved calculating the differences that arose between the base line model and the model with the direct impacts. The simulation produced measures of the changes in employment, income, and taxable sales attributable to the proposed fisn hatchery project for each of the years of the study period.

Comparison of IMPLAN and the Econometric Model

The econometric model represents a bottom-up approach to estimating economic impacts. That is, regional economic linkages are estimated using time series data on past regional economic activity. Historical variations in basic sector output, employment, and income are used to describe the historical pattern of output, employment and income generated by the regional economy.

In contrast, IMPLAN is constructed using a top-down approach. Regional economic relationships are based upon their counterparts at the national level. The regional economic relationships are estimated by a variety of assumptions about industry location, product availability, and distribution of technology.

The bottom-up approach of the econometric model has some advantages over the top-down approach of IMPLAN. With IMPLAN, differences between actual and assumed regional economic linkages may arise because modified national technological coefficients are utilized to estimate their regional counterparts, and the input-output model provides no easy method for testing the extent of these differences. The econometric model also generates predictions of regional economic activity over time. These predictions, when compared to actual values, can be used to test the fit of the estimated regional economic linkages.

Use of the time-series data on economic activity also allows the estimation of the time-dynamics of the impact multipliers. When a change in base sector activity occurs, the full economic impact of change is not immediately felt by the local economy. Since indirect and induced impacts are the result of the recirculation of spending within the regional economy, the initial impacts require time to work their way through the local economy. IMPLAN is a static model. Its impact multipliers are based upon the assumption that the direct impacts are sustained over time and that the economy has fully adjusted to its new long-run equilibrium levels of post-change economic activity.

On the other hand, the econometric model has disadvantages in relation to IMPLAN. In contrast to the detailed economic linkages of IMPLAN, limitations on the availability of regional time-series data impose constraints on the disaggregation of economic impacts in the econometric model. The econometric model provides little detail beyond basic aggregate employment, income, and spending impacts. Time-series data on regional variables are confined to measures of employment, wages, basic income measures, and sales subject to sales tax. No consistent measures of total regional output over time are available, and only limited sectorial output, such as certain cash crops, is obtainable.

The econometric model primarily provides estimates of the forward linkages of changes in base sector activity to the non-basic sector. The forward linkages measure the secondary spending effects on final goods and services. IMPLAN provides much more detailed analysis of the backward linkages that occur in the economy. It analyzes the expenditures of producers on intermediate goods produced within the region in addition to the spending impacts on final goods and services.

Notes

[1] Because of the large number of industries present in the two model economies and the possibility of large modeling errors in some background sectors of the economy, output, employment, and income impacts were aggregated into two-digit Standard Industrial Classification (SIC) code categories. Secondary data on employment and income are available from the Bureau of Economic Analysis and the Washington Department of Employment Security at the two-digit SIC code level of aggregation. More disaggregated data are generally suppressed due to individual confidentiality regulations of state and federal agencies. These data provide a basis for analyzing the relative impacts of the project on the economy. For example, this type of analysis indicates what percentage of sales, employment, or income of the eating and drinking industry will be linked to the impacts of research, fishing, and facilities maintenance in the KIYAK and RIVER models.

[2] The spreadsheet involved a two-step process. First, direct impacts were calculated in 1982 dollars for each of the project components (construction, recreational fishing, Native American fishing, research, and facilities operations and maintenance). These dollar impacts were allocated to the sectors that are utilized in the IMPLAN model. For example, the amount of eating and drinking expenditures, travel agency expenditures, etc. linked to research activity were calculated. Impacts on retail trade were margined with the assumption that the local economy would only receive the retail and wholesale margin from purchases such as groceries and gasoline. Although this ignores purchases from the large food processing industry in the region, it was assumed that the local industry is not a major supplier of local grocery stores.

In calculating the indirect impacts these direct impacts were multiplied by the appropriate columns of the Leontief matrix. Using our example, the eating and drinking expenditures linked to research activity were multiplied by the column of the Leontief for the eating and drinking industry. This process generated a matrix with the directly impacted industries as columns and all of the industries in the economy as rows. By summing across the rows, a column of total output impacts for every sector of the local economy was derived.

The second step was to convert these output impacts into employment and income impacts. These columns were generated by multiplying the total output impacts column by a column of sector-specific employment/output ratios and value added/output ratios, derived from IMPLAN data. This produced sector-specific impacts on employment and income in the model area.

CHAPTER 4

SPECIFICATION OF GEOGRAPHIC MODELS: TIME/PLACE/ACTIVITIES

The Bureau of Economic Analysis defines the area that will serve the Yakima/Klickitat Fisheries Enhancement Project as a functional economic area, dominated by Yakima (BEA, 1975). However, the Tri-Cities and Wenatchee trading centers compete strongly with Yakima, and all three centers are dominated by the Seattle-Puget Sound economy and to a lesser degree by the Portland economy. We eliminated the Wenatchee area (Chelan, Douglas, and Okanogan counties) from the study area because no project expenditures or sport fishing will take place there.

The construction, operation, and experimental aspects of the project will affect a large geographic area. The magnitude of the construction activity will attract bidders from outside the project area and will require some special skills that are not readily available in the area. Experimental activity will include field work and support activities in the area as well as laboratory work and analysis that will, in many cases, take place outside the area.

Fish destined for the headwaters of the Yakima River will be harvested in Klickitat, Benton, and Yakima counties in Washington as well as Hood River and Wasco counties in Oregon. A portion of the harvest will also be taken in the Lower Columbia River and Pacific Ocean fisheries, but impacts related to these areas are outside our study objectives.

The Native American harvest, which constitutes approximately 50% of the total, will take place primarily along the mid-Columbia and Klickitat rivers by members of the Yakima Nation. Their primary residential areas, however, are in Yakima County. Traditional family or group fishing sites are scattered throughout the reservation and surrounding communities. Regardless of where the fishing takes place, a portion of fishing expenditures will be made in the county of residence.

Economic impacts will develop from complex sequences of activities, each of which will variously affect or be affected by different subareas of the study area. To deal with this complexity we developed six input-output models based on three economic-geographic areas. The REGION area models encompass the Tri-Cities economy (Benton and Franklin counties), the Yakima Subbasin economy (Kittitas and Yakima counties), and the mid-Columbia Basin-Klickitat Subbasin economy (Klickitat, Hood River, and Wasco counties.) The KIYAK subbasin models include only the Yakima Subbasin economy, and the RIVER subbasin models only the mid-Columbia Basin-Klickitat Subbasin economy. Given the static nature of input-output models we constructed models that define two distinct project phases (CONSTRUCTION and HARVEST) for each of the three economic-geographic areas. In addition to these six input-output models, we developed two econometric models to analyze more completely economic impacts over time. These primary input-output and econometric models are described below in the following sections:

- KIYAK CONSTRUCTION
- KIYAK HARVEST
- RIVER CONSTRUCTION
- RIVER HARVEST
- REGION CONSTRUCTION and REGION HARVEST
- Econometric Models

A final section, "Additional Considerations," mentions secondary models that we ran to conduct sensitivity analyses and to account for external contingencies such as the locations of construction contractors.

KIYAK CONSTRUCTION

This is a model of the construction and start-up phases of the project for the northern part of the impact area. During this period pre-construction preparations conclude and construction begins, peaks, and concludes. There are no significant fishing expenditures for either the recreational fishery or the Native American fishery. However, the program of experimentation and monitoring is ongoing, and operations and maintenance require some expenditure. Although there will be no operations and maintenance expenditures for the central hatcheries during this period, some of the Phase II screens and the enhancement facilities are in operation.

Kittitas and Yakima counties are combined as one unit because of strong economic linkages between them. We allocated project construction activity to this model area on the basis of the geographic location of the physical construction, assuming that when construction occurs in the model area, a portion of the construction expenditures will be captured by the local economy. Details of the apportioning methods are presented in the next chapter. Research expenditures are divided among the model areas, based on location and nature of the research, with the KIYAK area capturing 80% of the research expenditures.

KIYAK HARVEST

This model portrays the impacts of the project during its long-term operational phase. During this period construction activity has ceased, operations and maintenance costs of the hatchery and related facilities are at a long-term average, experimental activity has wound down to a long term level, and fishing activity is at a long-term sustained yield level.

The model area includes the same two counties as the KIYAK CONSTRUCTION model, We allocated operations and maintenance costs on the basis of the physical location of the facilities and assumed that the KIYAK area will continue to capture 80% of the research activity generated by the project. Expenditures for recreational fishing were allocated to the model based on the estimated percent of the returning adult fish that would be available for recreational fishing.

RIVER CONSTRUCTION

This model includes Klickitat County in Washington as well as Wasco and Hood River counties in Oregon. These three counties make up an economic unit that will capture most of the expenditures related to the Klickitat River fishery. Like the KIYAK CONSTRUCTION model, this model is intended to reflect the start-up and construction phase of the project. We assumed that the model area captures 20% of the research expenditures and only those construction projects and operations and maintenance activities that occur there. During the start-up phase there is no significant increase in recreational or Native American fishery expenditures. There are no Phase II screening activities scheduled for the RIVER counties.

RIVER Harvest

This model portrays the long term harvest impacts of the project on the RIVER area (Klickitat, Wasco, and Hood River counties). In addition to harvest along the Klickitat River and its tributaries, this model incorporates the harvest of some hatchery fish in the stretch of the Columbia River adjacent to the three specified counties. During this modeling period, operations and maintenance expenditures of the outplanting facilities replace construction expenditures. Research activity declines to a long term average for the project. The Native American fishery and the recreational fishery grow to a level commensurate with the long term harvest projections of the project,

REGION Models: Construction/Harvest

These two models add Benton and Franklin counties to the aggregated geographic areas and regional economic functions of the previous models. Thus the regional models include geographic areas of six counties. There are several reasons for the development of these models. First, the inclusion of the Tri Cities (Richland, Pasco, and Kennewick) allows for the economic interaction of this metro area with Yakima and the RIVER counties. This is particularly Important in the case of construction, as it is highly probable that much of the contractor and subcontractor activity that is lost to the KIYAK and RIVER models will be captured by the Tri Cities, an area that still has some excess contractor capacity. Second, incorporation of these areas allows for the inclusion of some harvest of hatchery fish in the mainstem Columbia between the Klickitat/Benton county line and the confluence with the Yakima River. Native American fishing takes place along this stretch, although it is a minor portion of the total harvest. Finally, the inclusion of these two counties completes the economic picture of the Yakima and Klickitat subbasins; the six counties capture the economic activity which can be considered to be "local" with respect to the hatchery system.

Econometric Models

As discussed in Chapter 3, the primary purpose of the econometric analysis is to give a dimension of time-dynamics to the analysis. The regional econometric model focuses upon the three counties in which primary construction, operations and maintenance, experimentation, and harvest will occur. Given that the greatest portion of direct expenditures will occur in these three counties, the time dynamic is adequately incorporated into the analysis.

The second purpose of conducting the econometric analysis is to validate the accuracy of the input-output model. To accomplish this, we ran a separate econometric model, KIYAK ECONOMETRIC, on the aggregation of Kittitas and Yakima counties. This model provides a basis for comparison of multiplier size, indirect, and induced impacts with those of the largest of the IMPLAN two-county areas, KIYAK. The results of this comparison are reported in Chapter 7.

Additional Considerations in Input/Output Model Specification

Several additional models are minor variations of the six primary models. We made several runs to test the sensitivity of major harvest assumptions. These runs vary the catch rate and the boat to bank split (this analysis is reported in Chapter 6). We also ran a model to estimate expenditures when a significant portion of construction is awarded to a contractor within the boundaries of the regional model.

CHAPTER 5

DIRECT IMPACTS

Direct expenditures from four categories of activities are inserted into the I/O and econometric models in order to generate indirect and induced impacts. These categories are construction, operations and maintenance, experimentation, and harvest. The generation of expenditure estimates for the first three categories requires adjustments for time, function, and geography. The development of fish harvest expenditure estimates is more complex, requiring a number of assumptions about fishing techniques, catch rates, travel distances, etc. This chapter discusses the various categories of direct expenditure.

Construction Costs

Construction includes three subcategories of activities: construction of the hatchery system, construction associated with Phase II screening, and construction associated with habitat enhancement. Figure 5.1 presents an overview of the process used to estimate expenditures associated with these subcategory construction activities.

The "Proposed Master Plan" (FMC 1987) is the primary source for estimating hatchery construction costs. Appendix XI of the master plan details construction costs by function and location for all alternatives. For additional perspective, we consulted the author of the plan. We also obtained information from contractors and heads of other agencies who have managed the construction in similar projects. The site for the hatchery has not been selected at the time of this report; therefore, we have based our analysis on use Alternative 1, the alternative recommended in the master plan. As recommended by the author of the master plan, we increased construction costs by 25% over those in the plan to account for the additional costs of acclimation sites and several minor adjustments in hatchery components.

Hatchery construction costs were aggregated by site and function: first into Standard Industrial Classification codes, and then into eight IMPLAN codes. The Sunnyside site--later replaced by the Wapato site--was not included in the master plan. Because of the similarities of site and function to the Prosser site, we duplicated the cost estimates of the Prosser site as a surrogate measure for the Wapato facility.

As construction contracts have not yet been awarded, we had to estimate the percentage of construction that will be accounted for by local contractors as well as the proportion of local inputs. These estimates are based upon data that detail the availability of contractors in each subregion and upon the degree of local inputs used in similar construction projects. Engineers from several federal and county level agencies provided these measures, drawing upon their experiences with the construction of other hatcheries, screening projects, and passageway improvements. The resulting local capacity factors are presented in Table 5.1. Applying the numbers contained in this table to the total direct expenditures produces estimates

Figure 5.1

FLOW CHART OF COMPUTATIONAI, PROCEDURES FOR DIRECT EXPENDITURES ARISING FROM CONSTRUCTION ACTIVITIES:
HATCHERY, PHASE II, AND ENHANCEMENT

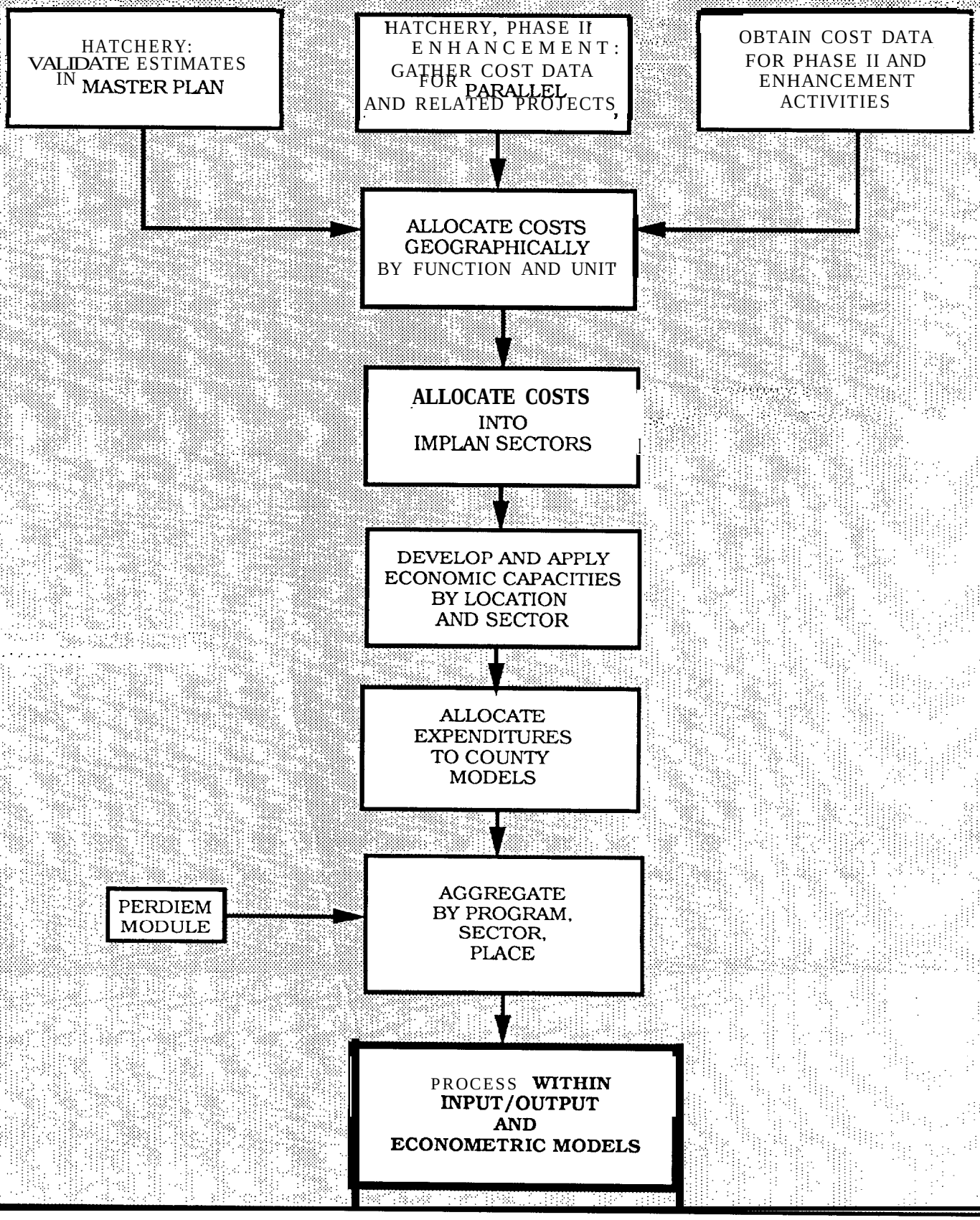


Table 5.1 Local Activity Capacity Factors, in Percent, for Yakima, Kittitas, and Klickitat Counties, Assuming Outside and In-Region Contractors.

		Out-of-Region Contractor			In-Region Contractor		
IMPLAN #	Description	Yakima	Kittitas	Klickitat	Yakima	Kittitas	Klickitat
47	Crushed Stone	100%	100%	100%	100%	100%	100%
48	Sand and Gravel	100	100	100	100	100	100
66	Res. Structures	100	70	70	100	70	70
67	Indust. Structures	40	25	25	100	25	25
68	Utility Structures	100	100	25	100	25	25
69	Highway and Street			100	100	100	100
72	Govt. Facilities	40	25	25	100	25	25
267	Concrete Block	100	100	100	100	100	100
269	Ready-Mixed Conc.	100	100	100	100	100	100
308	Fabricated Metals	100	100	100	100	100	100
453	Travel Agency	100	40	40	100	40	40
461	Other Wholesale	70	25	25	100	25	25
463	Other Retail	90	80	80	100	80	80
468	Ins. Agents\Brok.	40	5	5	100	5	5
470	Real Estate	100	30	30	100	30	30
471	Hotels and Lodging	100	100	100	100	100	100
489	Engineering\Arch.	100	5	5	100	5	5
491	Eat\Drink. Places	100	100	100	100	100	100
493	Auto Repair\Service	100	100	100	100	100	100
518	Fed. Govt. Enter.	100	100	100	100	100	100

Source: Compiled from primary data.

of local direct impacts. Because of its larger economy, central location, and availability of subcontractors, even with an out-of-area contractor Yakima County has the largest capacity factors, particularly in those sectors that are considered to be "heavy construction."

Tables 5.2, 5.3, and 5.4 present the construction expenditures for Yakima, Kittitas, and Klickitat counties, respectively. The hatchery, Phase II (for Yakima and Kittitas counties), enhancement, and total construction expenditures columns are not margined for capacity factors. That is, the entries show the total construction spending by sector, regardless of the proportion of in-county and out-of-county contractors or the sources of materials. However, the last columns on the right of Table 5.2 designate the direct impacts on the local Yakima County economy if major contracts are awarded to out-of-area or to local contractors. Thus the two columns represent total local expenditures, after adjustment for local capacity is made by applying the capacity factors presented in Table 5.1. There are also "out-of-area" columns in both Tables 5.3 and 5.4. These columns show expenditures on the local economy, after the adjustment for factor availability is made. There are no "local" columns on these tables, since local capacity for major contractor awards does not exist in Kittitas or Klickitat counties. In these smaller counties the preponderance of direct construction expenditures impact those sectors associated with excavation activities; the purchase of concrete, stone, and rock; the employment of general labor; and the purchases made by construction crews from the hospitality industries. Significant differences among counties arise on a per-sector basis because of differences in access costs and the nature and mix of sites within counties. Although total construction costs are remarkably evenly distributed across the three counties, after the availability adjustment is made, Yakima County clearly receives the largest share of direct construction impacts.

The Phase II expenditures in Tables 5.2 and 5.3 require additional comment: detailed construction cost estimates for Phase II screening activities were not available, only aggregate expenditures have been estimated. In order to model the economic impact upon specific sectors of the counties, the aggregate amounts are apportioned over sectors in the same proportions that were used in the Phase I screening activities. We used data from thirty Bureau of Reclamation screening and bypass projects constructed in the region between 1984 and 1989 to apportion total cost estimates into detailed IMPLAN sectors. In addition, we consulted regional contractors to determine likely sources of subcontractor activities. These contractors were Mountain States Construction of Sunnyside, George A. Grant of the Tri-Cities, and Pellinger Enterprises of the Tri-Cities.

The third subcategory of construction activities shown in Tables 5.2, 5.3, and 5.4 are those associated with the additional enhancement activities delineated in Appendix C. We obtained detailed estimates of these expenditures from the consultants who developed the plans for the Yakima and Klickitat subbasins. (See Appendix C for details.) Apportionment data derived for the screening and bypass estimates were used to allocate these construction expenditures into individual IMPLAN sectors.

Table 5.2 Total Construction Expenditures for Hatchery, Phase II Screening, and Enhancement for Yakima County, in 1989 Dollars; Aggregated for the 1990-1995 Period.

Implan #	Description	Total	<a> Margined for Local Contractor	<b> Margined for Out of Area Contractor
47	Crushed Stone	243,090	243,090	243,090
48	Sand and Gravel	134,508	134,508	134,508
66	Res. Structures	153,044	153,044	153,044
67	Indust. Structures	2,419,266	2,419,266	967,707
68	Utility Structures	3,015,974	3,015,974	1,206,390
69	Highway and Street	350,154	350,154	350,154
72	Govt. Facilities	2,264,340	2,264,340	905,736
267	Concrete Block	148,169	148,169	148,169
269	Ready-Mixed Conc.	736,410	736,410	736,410
308	Fabricated Metals	2,270,648	2,270,648	2,270,648
453	Travel Agency			
461	Other Wholesale	25,641	25,641	17,949
463	Other Retail	190,218	190,218	171,196
468	Ins. Agents\Brok.	275,273	275,273	110,109
470	Real Estate	349,484	349,484	349,484
471	Hotels and Lodging			
481	Computer Services	514,871	514,871	514,871
491	Eat\Drink. Places			
493	Auto Repair\Service			
518	Fed. govt. Enter.	514,871	514,871	514,871
	Totals	11,735,601	11,735,601	7,115,853

Source: Derived from master plan (FMC 1987) data and from data Supplied by sources listed in Chapter 5.

<a> Total column multiplied by those capacity availabilty factors of Table 5.1 aggregated for construction by local contractors.

<b> Total column multiplied by those capacity availabilty factors of Table 5.1 aggregated for construction by out of area contractors.

Table 5.3 Total Construction Expenditures for Hatchery, Phase II Screening and Enhancement for Kittitas County, in 1989 Dollars; Aggregated for the 1990-1995 Period.

Implan #	Description	Total	Margined for Out of Area Contractor
47	Crushed Stone	216,533	216,533
48	Sand and Gravel	112,333	112,333
66	Res. Structures	283,370	198,359
67	Indust. Structures	1,951,606	487,902
68	Utility Structures	2,808,974	702,243
69	Highway and Street	346,523	346,523
72	Govt. Facilities	1,777,153	444,288
267	Concrete Block	133,946	133,946
269	Ready-Mixed Conc.	623,248	623,248
308	Fabr. Struct. Metals	55,534	55,534
453	Travel Agency		
461	Other Wholesale	15,375	3,844
463	Other Retail	93,218	74,574
468	Ins. Agents\Brokers	271,739	13,587
470	Real Estate	360,405	108,122
471	Hotels and Lodging		
481	Computer Services		
491	Eating\Drink. Places		
493	Auto Repair\Service		
518	Fed. govt. Enter.		
Totals		8,309,218	3,320,907

Source: Derived from master plan (FMC 1987) data and from data supplied by sources listed in Chapter 5.

Table 5.4 Total Construction Expenditures for Hatchery, Phase II Screening and Enhancement for Klickitat County, in 1989 Dollars; Aggregated for the 1990-1995 Period.

Implan #	Description	Total	<a> Margined for Out of Area Contractor
47	Crushed Stone	181,019	362,038
48	Sand and Gravel	66,264	132,528
66	Res. Structures	172,173	241,041
67	Indust. Structures	772,981	386,491
68	Utility Structures	2,097,440	1,048,720
69	Highway and Street	656,920	1,313,840
72	Govt. Facilities	1,781,206	890,603
267	Concrete Block	118,890	237,780
269	Ready-Mixed Conc.	400,116	800,233
308	Fabr. Struct. Metals	10,971	21,943
453	Travel Agency		
461	Other Wholesale	3,750	1,875
463	Other Retail	136,483	218,372
468	Ins. Agents\Brokers	285,191	28,519
470	Real Estate	415,013	249,008
471	Hotels and Lodging		
481	Computer Services		
491	Eating\Drink. Places		
493	Auto Repair\Service		
518	Fed. govt. Enter.		
	Totals	6,257,980	5,435,215

Source: Derived from master plan (FMC 1987) data and from data Supplied by sources listed in Chapter 5.

<a> Total column multiplied by those capacity availabilty factors of Table 5.1 aggregated for construction by out of area contractors.

Operations and Maintenance

Operations and maintenance include three subcategories that parallel those of construction: operations and maintenance impacts associated with the hatchery, Phase II, and enhancement. Figure 5.2 shows the overall process of developing direct and indirect impacts that result from operations and maintenance activities. Operations and maintenance expenditures for the hatchery system are presented in some detail in the master plan (FMC, 1987). Operations and maintenance expenditures for the Phase II and enhancement subcategories are available only in aggregate form, which necessitated developing sectorial estimates based on similar projects. Each subcategory is considered below.

The master plan (FMC, 1987) was the primary source of operations and maintenance estimates for the hatchery. Operating costs consisted of labor, fish food, electric power, and supplies. FMC (1987) estimates of annual costs were:

Labor	$ 583,000
Food	448,000
Electricity	114,000
Supplies	175,000
TOTAL	$1,320,000

As these were projections of cost for the operational hatchery, they were expressed in 1994 dollars. To make our measures consistent with other direct expenditures, these values were adjusted to 1989 dollars and allocated into the nine IMPLAN categories (See Table 5.5.). Operations and maintenance expenditures were allocated to the three counties based on conversations with the author of the master plan and individuals in the WDF. We prorated the allocations according to the original capital cost accounted for by each location. As a result, the operations and maintenance expenditures, like the construction costs, are distributed relatively evenly across the three counties. Labor (IMPLAN code 525) and fish food (IMPLAN code 103) account for most of the hatchery operations and maintenance costs.

Phase II screening operations and maintenance expenditures were also only available in aggregate at the time of this report. Because construction will be undertaken on the basis of individual sites, some sites will be completed and in operation while others will not yet be under construction. Therefore, the expenditures in current dollars begin at $200,000 in 1991 and increase to $400,000 in 1992, $750,000 in 1993, and $1,000,000 in 1994. Operations and maintenance expenditures will then be sustained at that level. In order to estimate the locational impact of these total operations and maintenance expenditures upon the region, we assumed that expenditures on operations and maintenance would be sectorially proportional to construction spending, as is the case for hatchery operations and maintenance. The exceptions are the exclusions of hatchery expenditures for fish food and electricity that are not part of Phase II operations and maintenance costs. Allocation of Phase II expenditures will closely follow the allocation of hatchery expenditures. Additional

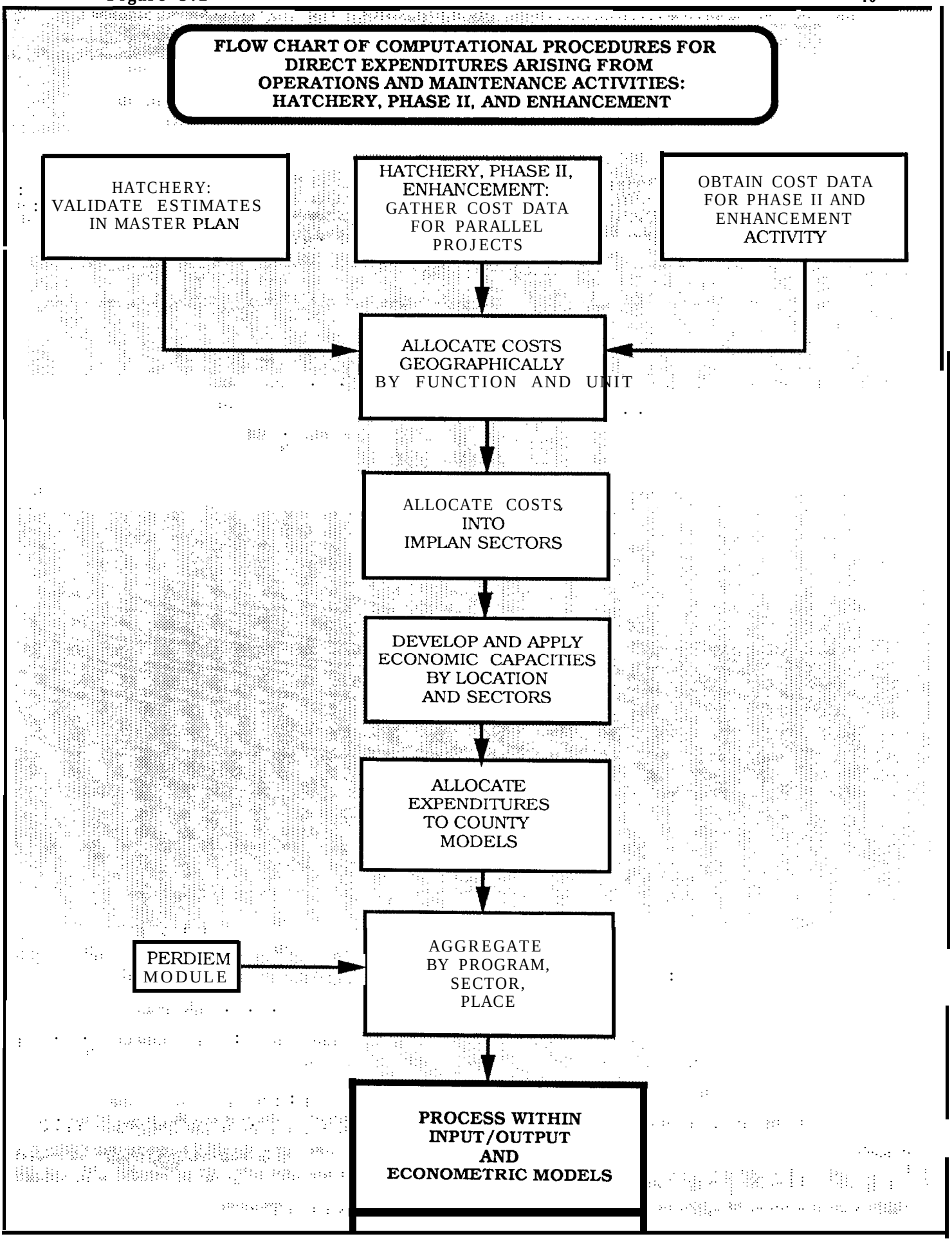

FLOW CHART OF COMPUTATIONAL PROCEDURES FOR DIRECT EXPENDITURES ARISING FROM OPERATIONS AND MAINTENANCE ACTIVITIES: HATCHERY, PHASE II, AND ENHANCEMENT
HATCHERY: VALIDATE ESTIMATES IN MASTER PLAN
HATCHERY, PHASE II, ENHANCEMENT: GATHER COST DATA FOR PARALLEL PROJECTS
OBTAIN COST DATA FOR PHASE II AND ENHANCEMENT ACTIVITY
ALLOCATE COSTS GEOGRAPHICALLY BY FUNCTION AND UNIT
ALLOCATE COSTS INTO IMPLAN SECTORS
DEVELOP AND APPLY ECONOMIC CAPACITIES BY LOCATION AND SECTORS
ALLOCATE EXPENDITURES TO COUNTY MODELS
PERDIEM MODULE
AGGREGATE BY PROGRAM, SECTOR, PLACE
PROCESS WITHIN INPUT/OUTPUT AND ECONOMETRIC MODELS

Table 5.5 Operations and Maintenance Expenditures for Klickitat, Yakima and Kittitas Counties, in 1989 Dollars; Aggregated for the 1996-2015 period.

IMPLAN #	Description	Yakima	Kittitas	Klickitat
	Hatchery			
74	Maint. and Repair	250,716	243,119	212,729
103	Prepared Feeds, N.E.C	192,660	186,823	163,470
461	Other Wholesale	32,254	7,819	1,710
463	Other Retail	43,005	33,361	23,353
520	St. and Loc. Utility	49,025	47,540	41,597
	Phase II			
74	Maint. and Repair	240,964	152,610	
461	Other Wholesale	18,071	9,157	
463	Other Retail	15,060	7,631	
493	Auto Rep.\Service	12,049	7,630	
520	St. and Loc. Utility	15,060	9,539	
	Enhancement			
413	Mobile Homes	2,169	1,446	
462	Recr. Retail	5,729	3,820	
518	Fed. Govt. Enter.	4,241	2,828	
520	St. and Loc. Utility	8,983	5,989	1,113
525	Govt. Industry	64,591	43,060	6,888
	Totals	954,576	762,371	450,859

Source: Derived from master plan (FMC 1987) data and from data Supplied by sources listed in Chapter 5.

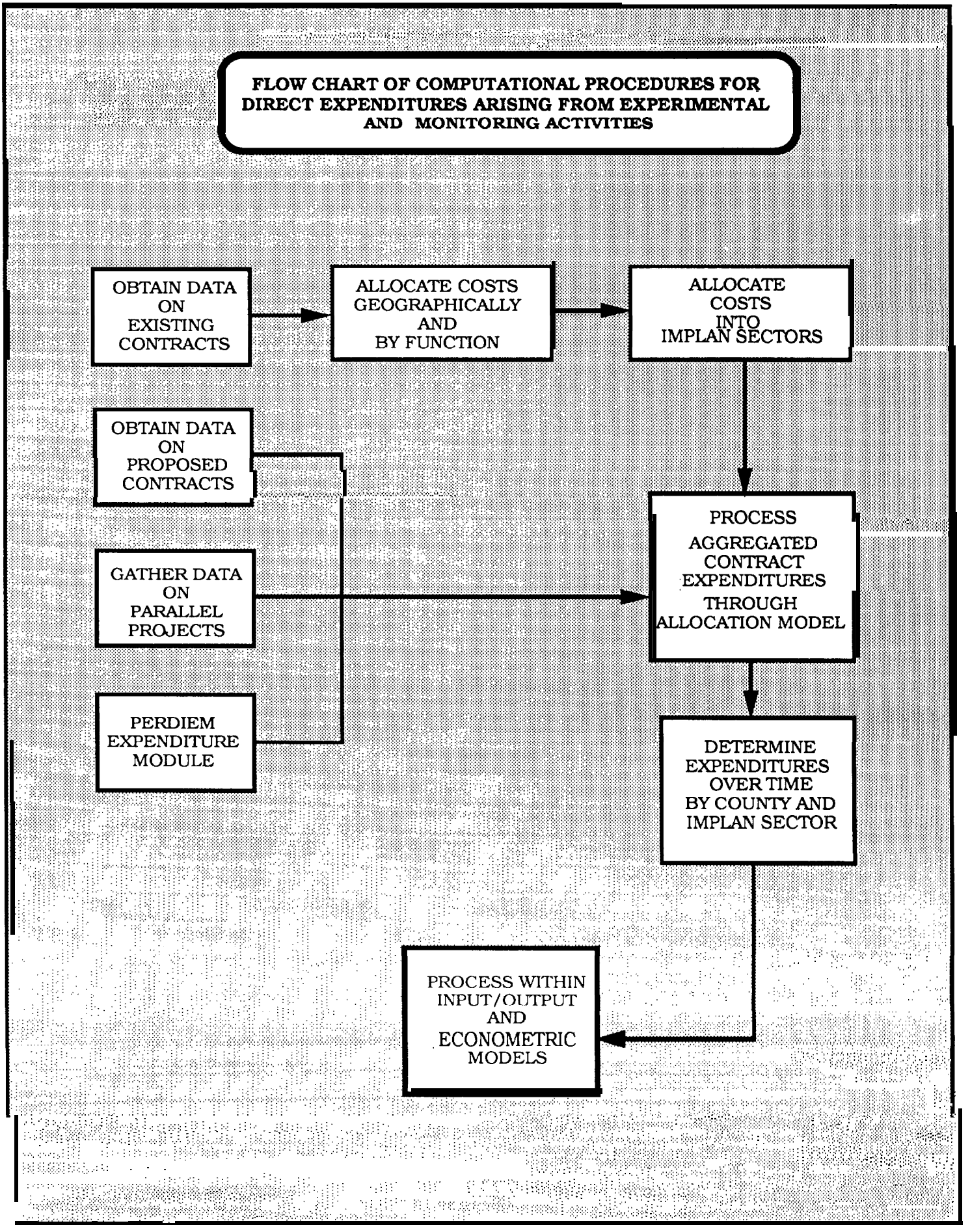
expenses were allocated into IMPLAN sectors 484 (equipment repair) and 74 (maintenance and repair). The resulting annual expenditures at Phase II maturity by county are presented in Table 5.5. (Note the predominance of labor costs, represented as IMPLAN Sector 525.)

The final component of operations and maintenance expenditures relates to enhancement activities. As with enhancement construction expenditures, the aggregate amounts of these operations and maintenance expenditures were obtained from the authors of the subbasin plans. These amounts are noted in Appendix C. The aggregate amounts were apportioned into IMPLAN sectors in a manner parallel to the apportionment of the Phase II operations and maintenance expenditures. These are are also shown in Table 5.5.

Experimental Program

The experimental design and monitoring program is a third category of hatchery-related activities that generate direct, and ultimately in indirect and induced, economic impacts within the region. Because of uncertainty surrounding supplementation processes--both in general and with respect to the specific river subbasins--the hatchery program includes a significant level of activities to monitor and evaluate the supplementation program. This research is designed to reduce uncertainties about the genetic implications of outplanting, stock productivity, and the effects of habitat and passage improvements. The monitoring and evaluation program will be coupled with an adaptive management process by which the management strategy is adjusted according to the evolving state of knowledge (FMC 1987). The evaluation of the outplanting program will focus upon genetics, species interactions, and supplementation methodology.

Performance of experimental design and treatment studies will require an array of expenditures for professional biologists, support personnel, monitoring equipment, and other associated personnel and equipment. The work will be performed by both resident personnel and by consultants from out of the study area. To the extent that these direct expenditures are made within the region, they generate indirect and induced impacts. We have also included in this category some hatchery related contract expenditures that are not part of the experimental design and treatment program but have parallel expenditure patterns. In order to derive the most useful multipliers, the IMPLAN model requires expenditure inputs at a relatively detailed level. The process of developing direct expenditures for the experimental and monitoring activities is outlined in Figure 5.3. Because line-item budgets exist for the years 1990-95 for much of the experimental and monitoring program, the development of detailed categories of expenditures is relatively simple. For later years, there exist only broad measures of program goals and expenses. In order to estimate the requisite detail, the proportions of the known line-item budgets were projected into the more distant time periods. This process projects the ratios of specified types of detailed expenditures to total spending and projects the proportion of expenditures accruing to each county, based upon the earlier contracts. The existing line item contracts include:


FLOW CHART OF COMPUTATIONAL PROCEDURES FOR DIRECT EXPENDITURES ARISING FROM EXPERIMENTAL AND MONITORING ACTIVITIES
OBTAIN DATA ON EXISTING CONTRACTS
ALLOCATE COSTS GEOGRAPHICALLY AND BY FUNCTION
ALLOCATE COSTS INTO IMPLAN SECTORS
OBTAIN DATA ON PROPOSED CONTRACTS
GATHER DATA ON PARALLEL PROJECTS
PERDIEM EXPENDITURE MODULE
PROCESS AGGREGATED CONTRACT EXPENDITURES THROUGH ALLOCATION MODEL
DETERMINE EXPENDITURES OVER TIME BY COUNTY AND IMPLAN SECTOR
PROCESS WITHIN INPUT/OUTPUT AND ECONOMETRIC MODELS

- the Cle Elum Sockeye Restoration Feasibility Study
- the WDF budget for the experimental design, planning and monitoring, and evaluation tools/approach development
- the W. Lerrick budget
- the YKPP EDWG Activities Budget
- the CWU Economic Impact Budget
- the YIN Hatchery Coordination Budget
- the Water Supply Analysis Budget
- the Battelle Laboratory Screening Effectiveness Budget
- the Radio Telemetry Study
- Yakima Hatchery Experimental Design
- Upper Yakima River Resident Trout Study
- Environmental Assessment Review Technical Assistance

Table 5.6 details the percentage of total contract amounts that on the average, we estimate will be spent within the study area by specific sectors. These percentages are used to project detailed expenditures by category to the following projects for which only aggregate expenditure estimates are now available: Fish Pond Renovation, Trapping Predesign, Environmental Work, Lower River Trap, and Long-term Monitoring and Evaluation. One of these projects--Final Design--is not part of the experimental project; but, because of the nature of the work, the direct relationship to the hatchery, and the generation of similar balance of local and consultant activities, the experimental program is the most appropriate area of direct expenditures in which to tally these impacts.

Local expenditures by professionals from other agencies who visit the sites for purposes of contract activity, agency coordination, meetings, and observation are also included in the experimental category. Drawing upon the visits of the past and assuming typical per diem-compensated expenses, these visitors spent $45 per visitor day. The $45 is apportioned according to the following categories: lodging, 50%; eating, 35%; auto, 6%; recreation-related retail, 2%; other retail, 7%. Two hundred visitor days are estimated for each year of the 1990-95 period and 100 visitor days per year are estimated from 1996 on.

Tables 5.7, 5.8, and 5.9 present the direct experimental and monitoring expenditures in 1989 dollars by county and by twelve categories of expenditures from construction to the beginning of the harvest period. Two time periods, the years 1990 and 1991, require minimal estimation because the categories of spending are listed in extant contracts. We estimated detailed expenditures for the 1992 to harvest interval by means of the processes described previously. Yakima County receives 29% of the expenditures, while Kittitas County and Klickitat County receive 18% and 13%, respectively. The larger allocation for Yakima County results from its central location and from the lack of availability of air transportation and other services in the smaller counties. Clearly, the largest categories of expenditures, IMPLAN sectors 482 and 489, are salaries for professionals and staff. In summary, the total direct impacts upon the local study areas represent approximately 25% of the total budget for the experimental program. The remaining 75% will be spent outside the study region because of the expected margining of expenditures into external sources of contractors, activities, and supplies.

Table 5.6 Percentage of Total Experimental and Monitoring Budgets Spent in the Study Area, by Category of Spending.

IMPLAN #	Sector	Percentages Spent In Study Area
482	Local Wage & Salary	.138
471	Hotel	.001
463	Retail	,047
462	Recreation Related Retail	,001
(1)	Fish Related Supplies	.083
68	Capital Construction	.042
492	Auto	,016
453	Travel Agency	,042
470	Office Lease	.007
(2)	Office Equipment	.005
(3)	Local Per Diem	.024
491	Eating & Drinking	,007
450	Air Charter	.001
489	Local Overhead	.080
	TOTAL	,438

Notes: (1) In calculation of direct expenditures, the expenditures were incorporated into sector 463.
(2) In calculation of direct expenditures, the expenditures were incorporated into sector 463.
(3) In calculation of direct expenditures, the expenditures were parceled into sectors 471, 463, 491, 492, and 472.

Table 5.7 Expenditures for Experimentation and Monitoring Activities, Yakima County, for 1990-2015, in 1989 Dollars.

Function and Implan #	Description	Years 1990	1991	1992	1993	1994	1995	<a> 1996-2015
68	Utility Structures	72,753	72,753	44,664	44,664	44,664	44,664	37,705
365	Office Mach. N.E.C	56,236	56,236	34,524	34,524	34,524	34,524	29,145
450	Air Transportation	38,933	38,933	23,901	23,901	23,901	23,901	20,176
453	Travel Agency	141,574	141,574	86,914	86,914	86,914	86,914	73,373
462	Recr. Retail	8,848	8,848	5,431	5,431	5,431	5,431	4,585
463	Other Retail	38,343	38,343	23,539	23,539	23,539	23,539	19,871
470	Real Estate	35,786	35,786	21,970	21,970	21,970	21,970	18,546
471	Hotels and Lodging	26,544	26,544	16,295	16,295	16,295	16,295	13,756
482	Mgmt.\Consult. Serv.	330,339	330,339	206,336	206,336	206,336	206,336	174,738
489	Engineering\Arch. Serv.	251,686	251,686	154,515	154,515	154,515	154,515	130,440
491	Eat\Orink. Places	15,926	15,926	9,778	9,778	9,778	9,778	8,254
492	Auto Rental\Leasing	51,123	51,123	65,135	65,135	65,135	65,135	26,495
	Totals	1,068,089	1,068,089	693,001	693,001	693,001	693,001	557,084

Source: Calculated by applying Table 5.6 values to total projected experimentation and monitoring contract expenditures, as described in Chapter 5.

<a> Values are for each year of this period.

Table 5.8 Expenditures for Experimentation and Monitoring Activities, Kittitas County, for 1990-2015, in 1989 Dollars.

Function and Implan #	Description	Years 1990	1991	1992	1993	1994	1995	<a> 1996-2015
68	Utility Structures	10,913	10,913	6,699	6,699	6,699	6,699	5,656
365	Office Mach. N.E.C	17,303	17,303	10,623	10,623	10,623	10,623	8,968
450	Air Transportation	4,325	4,325	2,655	2,655	2,655	2,655	2,241
453	Travel Agency	15,101	15,101	9,271	9,271	9,271	9,271	7,827
462	Recr. Retail	6,881	6,881	4,224	4,224	4,224	4,224	3,566
463	Other Retail	9,438	9,438	5,794	5,794	5,794	5,794	4,891
470	Real Estate	3,303	3,303	2,028	2,028	2,028	2,028	1,712
471	Hotels and Lodging	20,645	20,645	12,674	12,674	12,674	12,674	10,699
482	Mgmt.\Consult. Serv.	198,203	198,203	116,681	116,681	116,681	116,681	102,723
489	Engineering\Arch. Serv.	2,360	2,360	1,449	1,449	1,449	1,449	1,223
491	Eat\Drink, Places	12,386	12,386	7,605	7,605	7,605	7,605	6,419
492	Auto Rental\Leasing	15,730	15,730	9,656	9,656	9,656	9,656	8,153
	Totals	316,587	316,587	189,358	189,358	189,358	189,358	164,075

Source: Calculated by applying Table 5.6 values to total projected experimentation and monitoring contract expenditures, as described in Chapter 5.

<a> Values are for each year of this period.

Table 5.9 Expenditures for Experimentation and Monitoring Activities, Klickitat County, for 1990-2015, in 1989 Dollars.

function and Implan #	Description	Years 1990	1991	1992	1993	1994	1995	<a> 1996-2015
6 8	Utility Structures	7.275	7,275	4,466	4,466	4,466	4,466	3.770
3 6 5	Office Mach. N.E.C	12,976	12,976	7,966	7,966	7,966	7,966	6,725
450	Air Transportation	38,933	38,933	23,901	23,901	23,901	23,901	20,176
453	Travel Agency	3,775	3,775	2,318	2,318	2,318	2,318	1,957
462	Recr. Retail	3,933	3,933	2,414	2,414	2,414	2,414	2,038
463	Other Retail	7,078	7,078	4,345	4,345	4,345	4,345	3,668
470	Real Estate	2,477	2,477	1,521	1,521	1,521	1,521	1,284
471	Hotels and Lodging	11,798	11,798	7,243	7,243	7,243	7,243	6,114
482	Mgmt.\Consult. Serv.	132,135	132,135	81,120	81,120	81,120	81,120	68,481
489	Engineering\Arch. Serv.	787	787	483	483	483	483	408
491	Eat\Drink. Places	7,078	7,078	4,345	4,345	4,345	4,345	3,668
492	Auto Rental\Leasing	11,798	11,798	7,243	7,243	7,243	7,243	6,114
	Totals	240,041	240,041	147,364	147,364	147,364	147,364	124,401

Source: Calculated by applying Table 5.6 values to total projected experimentation and monitoring contract expenditures, as described in Chapter 5.

<a> Values are for each year of this period.

Direct Expenditures from Increased Recreational Fishing

Estimating the direct recreational expenditures generated by an increase in the number of harvestable fish requires three general types of information. Obviously, one is an estimate of the net increase in harvestable fish. An estimate of recreationists' responses to the improved quality of fishing is equally important. And, finally, the expenditures associated with the behavioral responses of fishers must be estimated.

Errors in any one of these estimates will be compounded through the implied multiplication process. Accuracy is critically important, but the magnitude and timing of the fishery enhancement efforts are such that there is no way to specify the level of accuracy associated with each estimate. Thus, rather than relying on point estimates of unknown accuracy, our solution was to use a sensitivity analysis to describe a range of possible regional economic impacts.

Figure 5.4 presents a flow-chart outline of steps we followed to get from fish harvest estimates to an estimate of the direct expenditures that will be generated by the Yakima/Klickitat fishery enhancement project. These steps are described in detail below.

Sustainable Harvest

The target levels of production for the Klickitat/Yakima hatchery and outplanting facilities and the associated levels of sustainable harvest by species are presented in Tables 2.1 and 2.2 in Chapter 2.

Throughout the analysis we assumed that all harvestable fish (the sustainable terminal harvest) will be caught. The reasons for this assumption are that (1) with allowances for both harvests elsewhere and natural spawning escapement, these are actually biologists' best current estimates of the number of fish that will be harvested within the Yakima and Klickitat subbasins and the relevant portion of the Columbia River; (2) over-fishing or over-use is more of a problem with common property resources than under-use; and (3) if all potentially harvestable fish are not caught, regulations can be altered to ensure they will. Thus, we consider the terms "sustainable harvest" and "catch" synonymous. The sustainable harvests attributable to the construction and operation of the Yakima/Klickitat enhancement facilities are specified in Tables 2.1 and 2.2 as "Net Increase."

Recreational Fishing Responses--Number of Fishing Trips

When attempting to measure recreation expenditure impacts, the two most commonly used units of measure are "number of recreation days" and "number of trips." The choice between these two alternatives is of little consequence; one can be converted to the other simply by knowing the number of days spent on each recreation trip. We chose to use recreation trips for our analysis.

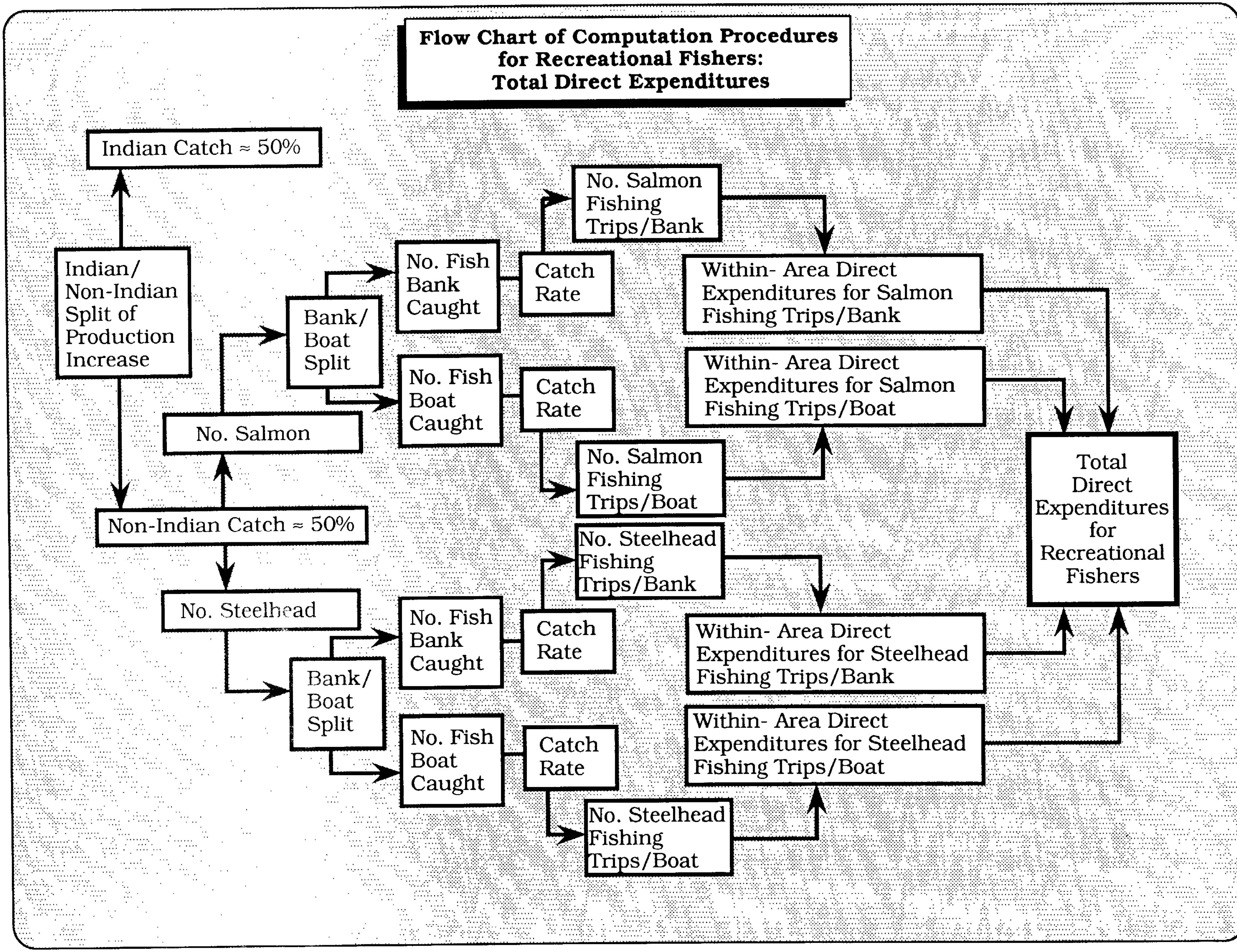

Flow Chart of Computation Procedures
for Recreational Fishers:
Total Direct Expenditures
Indian Catch ≈ 50%
Indian/ Non-Indian Split of Production Increase
Non-Indian Catch ≈ 50%
No. Salmon
No. Steelhead
Bank/ Boat Split
Bank/ Boat Split
No. Fish Bank Caught
No. Fish Boat Caught
No. Fish Bank Caught
No. Fish Boat Caught
Catch Rate
Catch Rate
Catch Rate
Catch Rate
No. Salmon Fishing Trips/Bank
No. Salmon Fishing Trips/Boat
No. Steelhead Fishing Trips/Bank
No. Steelhead Fishing Trips/Boat
Within- Area Direct Expenditures for Salmon Fishing Trips/Bank
Within- Area Direct Expenditures for Salmon Fishing Trips/Boat
Within- Area Direct Expenditures for Steelhead Fishing Trips/Bank
Within- Area Direct Expenditures for Steelhead Fishing Trips/Boat
Total Direct Expenditures for Recreational Fishers

Figure 5.4

Next we had to determine how many additional trips will be taken to harvest the increased number of fish. The literature and logic suggested that we focus our attention on estimating the number of fish caught per trip (the catch rate) and then convert the sustainable harvest increase to an estimate of the expected increase in number of trips taken by recreationists.

Proportion of Fish Caught by Bank and Boat Fishers

Both fishing success rates (catch per trip) and expenditures per trip vary depending upon whether recreationists fish from the bank or from boats. Available data and the judgment of biologists led us to assume that 80% of the salmon will be caught by boat fishers and the remaining 20% will be caught by bank fishers.[1] For the initial computer run, we assumed that 80% of the steelhead caught by recreationists will be caught by bank fishers and 20% will be caught by boat fishers.[2] For the sensitivity analysis we altered this ratio (see p. 78).

Catch Rates

Catch rates vary over time and from place to place, often dramatically. Possible reasons for this include changes in variables such as the sizes of fish runs, water conditions during fishing seasons, fishing skill levels, fishing techniques used, fishing effort expended, type (size and other physical characteristics) of river being fished, schooling or clumping behavior of fish at different fish density levels, and the target species. Appendix G presents a hypothesis about catch rates. To our knowledge, no one has satisfactorily quantified the relationships between these variables and salmonid catch rates for rivers like the Yakima and the Klickitat.[3] Nevertheless, there are some useful catch rate data available and existing data are adequate for bounding our sensitivity analyses.

The data show that catch rates for salmon and steelhead are usually different. Furthermore, bank and boat fishers clearly experience different catch rates.[4] They are particularly important because, the magnitude and composition of fishing expenditures associated with each of the four resulting combinations are different.

Salmon Catch Rates. Two sources of data for the Willamette/Clackamas spring chinook fishery were used to determine salmon catch rates. For brevity, they will be referred to as the 1988 Willamette study and the ODFW creel survey.[5]

The 1988 Willamette study data are primarily for boat anglers. (Of the sample observations, 95% were for boat fishers.) This study estimated the number of fish caught per trip to range from .13 to .18. These numbers serve as a useful check for the ODFW creel survey data.

The ODFW creel data facilitates two useful refinements. First, it permits separating the lower and middle Willamette data from the upper Willamette and Clackamas data. Neither of these two segments of the river system are

perfect surrogates for the Yakima/Klickitat, but the upper Willamette and Clackamas are more like the Yakima/Klickitat than the lower reaches of the Willamette. Furthermore, upper Willamette/Clackamas catch and fishing effort data are subdivided into boat and bank categories. Thus we chose to use this data for baseline salmon catch rates. We did, however, convert fishing effort figures from angler-days to recreation trips. For this we used the 1988 Willamette study mean estimate of 1.3 days per trip. As a result, and based primarily on the 1987 and 1988 ODFW creel survey numbers, we arrived at estimates of .19 salmon per trip for boat fishers and .09 salmon per trip for bank fishers.[6] (For further discussion of salmonoid catch rates, see Appendix C.)

Steelhead Catch Rates. Steelhead catch rates were based on information from the Idaho Department of Fish and Game (IFG). Creel surveys have been conducted in Idaho on a regular basis since 1983. Idaho data were available on the Salmon, Clearwater, and Snake rivers. The data covered the harvest of approximately 165,000 steelhead.

The Idaho river that was judged to be most similar to rivers in the study area was the Clearwater River. The Clearwater, like the Yakima, has been the object of a major fishery enhancement effort. Wild fish runs were severely depleted by 1970 and have been augmented by the Dvorak National Steelhead Hatchery, the largest steelhead hatchery in the United States.

IFG creel censuses indicate that boat fishers are responsible for 80% of the fishing effort on the Clearwater. Boat fishers are much more successful than bank fishers, harvesting 90% of the total sport fishing catch. In recent years the ratio of boat to bank fishers has been shifting towards increased use of boats. Shoreline crowding in favored fishing sites and differential success rates in boat and bank fishers are the probable factors in this shift (Interview with Kent Ball, State of Idaho, Department of Fish and Game, October 1989.).

Seven years of creel census data (1983-89) for the Clearwater was used to estimate bank and boat angler catch rates. Over this period catch rates for boat and bank anglers were calculated to be .19 fish per day for boat anglers and .08 fish per day for bank anglers. Using the estimate of 1.16 days per fishing trip results in a catch rate of .22 per trip for boat anglers and .10 for bank anglers.[7]

Per Trip Fishing Expenditures

The basic expenditure data for our analysis came from the 1988 Willamette study and a 1985 Idaho steelhead study.[8] Our goal was to produce four different per trip expenditure tables--one each for salmon boat fishers, salmon bank fishers, steelhead boat fishers, and steelhead bank fishers. Because it Is relatively recent data and is more detailed than the Idaho study, we used the Willamette study as a basic reference point in all four cases.[9] However, it was necessary to adjust the Willamette data to recognize three general types of differences between our study needs and the other two studies: (1) time and location differences, (2) salmon vs. steelhead expenditure differences, and (3) boat vs. bank fisher differences.

Time and Location Differences. First, for consistency, all dollar figures were adjusted to a 1989 base by using the Consumer Price Index. Second, all travel-related expenditures were adjusted for differences in average expected per-trip travel distance. In general, because the Willamette study area included Portland's relative high population density, the Willamette study mean round trip travel distance (eighty-eight miles) is less than what can be expected for our study region. Conversely, the Idaho study's mean round trip travel distance of 217.77 miles probably exceeds what is appropriate for this study. While most fishing locations within our study areas are no more than two hundred miles from coastal metropolitan areas, obviously not all recreationists will come from there; some will come from within the study area while others will come from other rural and inland urban areas outside of the study areas. Given this fact and the relative locations of the Willamette and Idaho study areas, we subtracted one-half of the difference between the travel distances reported by these other two studies from the Idaho study's mean travel distance, which resulted in 153 miles as a round trip travel distance. This translates into a 74% increase over the Willamette study travel distance and a 30% decrease from the Idaho study travel distance. These numbers were used to refine the travel expenditures of the Idaho and Willamette studies for use here.

Third, because the Willamette study's overnight accommodations expenses were relatively low due to the large proportion of fishers from the local area, the Idaho accommodations expenditures (adjusted for inflation) were utilized as lodging expenditures for all four alternatives.

Salmon vs. Steelhead Expenditure Differences. As might be expected, the adjustments for differences between salmon and steelhead fishing expenditures resulted in relatively minor divergences. The inflation-adjusted Idaho steelhead study variable costs are 106.41% of the Willamette study variable costs. With the exception of the previously mentioned lodging expenditures and transportation expenditures categories, all other steelhead fishing variable costs were adjusted upward by this margin. And, Willamette study figures without this adjustment were used as salmon fishing expenditures.

Boat vs. Bank Fisher Expenditure Differences. Our final general data adjustment was to reduce the Willamette study expenditures to recognize that bank fisher expenditures are less than boat fisher expenditures. The Willamette study figures represent boat fisher expenditures only. Therefore, to make this final adjustment we removed boating related expenditures (boat gas/oil expenses as well as rental of boat and/or fishing equipment expenses[10]).

This is the last of the expenditure data adjustments. It, along with the other adjustments specified above, is the basis for Tables 5.10 through 5.13.

Expenditures Made Within the Study Area

The next step in the process was to remove expenditures made outside the study area from the direct expenditure tables (Tables 5.10 through 5.13).

Table 5.10 Direct Expenditures Per Salmon Fishing Trip for Boat Fishers by IMPLAN Sector, in 1989 Dollars

IMPLAN #	Description	AT HOME	EN ROUTE	DESTINATION	TOTAL
462	RECREATION RELATED RETAIL TRADE				
	TRANSPORTATION @153 MILES	9.32	12.82	1.88	24.02
	BOAT GAS/OIL	3.20	1.58	1.62	6.40
	GROCERIES	6.58	3.60	1.97	12.14
	FISHING TACKLE	1.46	2.96	2.22	6.64
	MISC. SUPPLIES	0.17	0.32	0.31	0.80
471	CAMPING/LODGING	0.22	1.47	14.67	16.36
484	BOAT/TACKLE RENTAL	0.03	0.00	0.53	0.55
491	EATING AND DRINKING EST.	0.06	3.01	7.99	11.06
502	GUIDE SERVICES	0.40	0.00	2.40	2.80
521	FEES AND LICENSES	0.10	0.00	0.40	0.50
	TOTALS	21.54	25.76	33.98	81.28

Table 5.11 Direct Expenditures Per Salmon Fishing Trip for Bank Fishers by IMPLAN Sector, in 1989 Dollars

IMPLAN #	Description	AT HOME	EN ROUTE	DESTINATION	TOTAL
462	RECREATION RELATED RETAIL TRADE				
	TRANSPORTATION @153 MILES	9.32	12.82	1.88	24.02
	BOAT GAS/OIL	0.00	0.00	0.00	0.00,
	GROCERIES	6.58	3.60	1.97	12.15
	FISHING TACKLE	1.46	2.96	2.22	6.64
	MISC. SUPPLIES	0.17	0.32	0.31	0.80
471	CAMPING/LODGING	0.22	1.47	14.67	16.36
484	BOAT/TACKLE RENTAL	0.00	0.00	0.00	0.00
491	EATING AND DRINKING EST.	0.06	3.01	7.99	11.06
502	GUIDE SERVICES	0.40	0.00	2.40	2.80
521	FEES AND LICENSES	0.10	0.00	0.40	0.50
	TOTALS	18.31	24.18	31.84	74.33

Table 5.12 Direct Expenditures Per Steelhead Fishing Trip for Boat Fishers by IMPLAN Sector, in 1989 Dollars

IMPLAN #	Description	AT HOME	EN ROUTE	DESTINATION	TOTAL
462	RECREATION RELATED RETAIL TRADE				
	TRANSPORTATION @153 MILES	9.32	12.82	1.88	24.02
	BOAT GAS/OIL	3.99	1.97	2.02	7.98
	GROCERIES	8.20	4.49	2.45	15.14
	FISHING TACKLE	1.83	3.69	2.77	8.29
	MISC. SUPPLIES	0.21	0.40	0.38	0.99
471	CAMPING/LODGING	0.22	1.47	14.67	16.36
484	BOAT/TACKLE RENTAL	0.03	0.00	0.66	0.69
491	EATING AND DRINKING EST.	0.08	3.75	9.97	13.80
502	GUIDE SERVICES	0.50	0.00	3.00	3.49
521	FEES AND LICENSES	0.13	0.00	0.50	0.62
	TOTALS	24.50	28.59	38.29	91.38

Table 5.13 Direct Expenditures Per Steelhead Fishing Trip for Bank Fishers by IMPLAN Sector, in 1989 Dollars

IMPLAN #	Description	AT HOME	EN ROUTE	DESTINATION	TOTAL
462	RECREATION RELATED RETAIL TRADE				
	TRANSPORTATION @153 MILES	9.32	12.82	1.88	24.02
	BOAT GAS/OIL	0.00	0.00	0.00	0.00
	GROCER1 ES	8.20	4.49	2.45	15.14
	FISHING TACKLE	1.83	3.69	2.77	8.29
	MISC. SUPPLIES	0.21	0.40	0.38	0.99
471	CAMPING/LODGING	0.22	1.47	14.67	16.36
484	BOAT/TACKLE RENTAL	0.00	0.00	0.00	0.00
491	EATING AND DRINKING EST.	0.08	3.75	9.97	13.80
502	GUIDE SERVICES	0.50	0.00	3.00	3.49
521	FEES AND LICENSES	0.13	0.00	0.50	0.62
	TOTALS	20.48	26.62	35.62	82.72

In light of the Willamette study data and differences between the Willamette study area and our study region, we assumed that approximately 50% of the recreational fishers harvesting fish within the study region would come from outside the region. Therefore, only 50% of the "at home" expenditures and 75% of the "enroute" expenditures were included in our computations.[11]

Total Recreational Expenditures

The final step in estimating the direct recreational impact of the fishery enhancement project was to multiply the number of trips times the associated expenditure figures. After doing this for each of the four recreational fishing categories the numbers were totaled and allocated to the appropriate industry categories. After a discussion of expenditures related to Native American fishing (Table 5.14), total recreational expenditures are presented in Table 5.15 under the heading "Sport Fishing Totals."

Direct Expenditures from Increased Native American Fishing

Estimating the direct expenditures associated with the expected increase in Native American fishing is complicated by the diverse fishing techniques--rod and reel, gill net, and dip net. Native Americans employ in the study area.The first is similar to the way recreationists fish; the second is similar to one of the ways that commercial fishers harvest fish; and the third is, for the most part, unique to Native American cultures. As far as we know, no survey data are available for Native American expenditures for fishing on the Klickitat, Yakima, or Columbia rivers. We relied heavily upon information provided by Steven Parker, Yakima Indian Nation Harvest Manager concerning harvesting methods, numbers of fishers, and composition of fishing groups, travel patterns, and catch rates (see Appendix H.)

The basic procedure used to estimate Indian fishing expenditures included the following steps: (1) estimating the portion of total sustainable harvest that is likely to be allocated to Native American fishers by using the Klickitat and Yakima River Basin Plans and information from biologists; (2) estimating the sustainable Indian harvest for each fishing technique for the Klickitat, Yakima, and relevant portions of the Columbia rivers; (3) computing the number of fishing trips for local residents and for campers by using expected catch rates for each fishing technique and each river system; (4) determining per trip fishing expenditures by making the following adjustments in recreational fishing expenditures: eliminating camping/lodging costs, guide fees, and other fees and licenses; re-estimating transportation expenditures by using estimated travel distances; and reducing grocery, fishing tackle, and eating and drinking establishment expenses to recognize lifestyle differences (see Table 5.14 for the resulting per trip expenditures); and (5) multiplying per trip expenditures by the number of trips to give the total expenditures presented in Table 5.15 under the heading "Indian Fishing Totals."

Table 5.14 Expenditures Per Trip; Native American Fishing; by Implan Sector in 1989 Dollars.

Sector	
Transportation	$4.00
Groceries and Misc	10.00
Eating and Drinking	8.50
Boat Gas and Oil	5.00
Bait and Tackle	5.00
Total	32.5

Source: Compiled from Primary Data.

Table 5.15 Summary Table of Direct Expenditures by IMPLAN Sector for REGION Harvest Period in 1989 Dollars.

IMPLAN #	Description	O+M Totals	Experimentation Totals	SPORT FISHING Totals	INDIAN FISHING Totals	Totals
68	New Util. Struct.		$60,327		$16,750	$77,077
74	Maint. and Repair	$928,902				928,902
103	Prepared Feeds, N.E.C	467,056				467,056
365	Office Equip.		35,870			35,870
413	Metal Fabrication	2,979				2,979
433	Sport Goods			$511,821	42,009	553,830
450	Air Charter		17,934			17,934
453	Travel Agency		78,264			78,264
461	Other Whsle.	102,287				102,287
462	Ret-Related Retail	129,147	8,151	2,760,412	159,634	3,057,344
463	Other Retail	3,056	24,456			27,512
470	Office Leasing		22,826			22,826
471	Hotels and Lodging		24,455	1,495,739		1,520,194
482	Mgmt. and Consulting		276,753			276,753
484	Equip. Rental			26,569		26,569
489	Eng. and Arch.		130,440			130,440
491	Eating and Drinking		14,672	980,721	71,415	1,066,808
492	Vehicle Rental	14,806	16,305			31,111
493	Vehicle Repair	14,485	16,305			30,790
499	Commercial Recreation			250,440		250,440
518	Govt. Enterprise	5,825				5,825
520	Electric Util.	143,720				143,720
521	State and Local Govt.			43,641		43,641
525	Govt. Industry	99,722				99,722
	Totals	$1,911,985	$726,758	$6,069,343	$289,808	$8,997,894

Source: Compiled from previous Chapter 5 tables.

The resulting total direct expenditures are crude estimates. However, this is not a particularly serious problem because higher Indian catch rates and lifestyle differences reduce total Indian expenditures to a relatively small fraction of recreationists' total direct fishing expenses. Therefore, the IMPLAN-estimated economic impacts from Native American expenditures were relatively small.

Table 5.15 summarizes the harvest period direct expenditures for the REGION model. The county level direct expenditures for operations and maintenance are aggregated to obtain REGION totals, as are the experimentatlon and monitoring expenditures. Sport and Native American fishing expenditures for REGION are also presented by IMPLAN sector and as totals.

Notes

[1] The proportion of salmon caught by each of these two categories of recreationists varies by year, by species, and by river system. For example, for 1985, 1986, and 1987, the Lower Columbia (excluding the Estuary Salmon, Buoy 10, fishery) combined Oregon and Washington percentages of boat-caught salmon (spring, summer, and fall chinook and coho) ranged from 61.4% to 78.2%. (Oregon Department of Fish and Wildlife, Fish Division, 1985, 1986, and 1987 Lower Columbia River (Bonneville to Astoria) and Estuary Salmon (Buoy 10) Recreational Fishery.) As reported by the 1988 Willamette Study cited earlier for the Upper Willamette/Clackamas spring chinook fishery the percent of fish caught by boat fishers ranged up to 90.2 in 1988.

[2] As with salmon, the proportion of steelhead caught by each of these two categories of recreational fishers varies by year and by river system. For example, for 1985, 1986, and 1987, the Lower Columbia combined Oregon and Washington percentages of boat and bank caught steelhead ranged from 31.8 and 68.2, respectively, to 78.5 and 21.5, respectively. (Oregon Department of Fish and Wildlife, Fish Division, 1985, 1986, and 1987 Lower Columbia River (Bonneville to Astoria) and Estuary Salmon (Buoy 10) Recreational Fishery.)

[3] For an interesting study of the relationship between salmon abundance and sport-fishing catchability coefficients, even though it does not provide data that can be utilized for this study--primarily because it pertains to relatively low fish densities--see Peterman, Randall M. and Steer, G. J., "Relationship Between Sport-Fishing Catchability Coefficients and Salmon Abundance," Transactions of the American Fisheries Society, 1981, pp. 585-593.

[4] The Oregon Department of Fish and Wildlife's annual publication titled "The Lower Columbia River (Bonneville to Astoria) and Estuary Salmon (Buoy 10) Recreational Fisheries" consistently reports bank catch rates to be approximately 42 to 50% lower than boat catch rates.

[5] Both sets of data are presented in The Research Group, "Final Report Survey and Economic Impact Analysis of the 1988 Willamette Run Spring Chinook Sport Fishery," Oregon Department of Fish and Wildlife, September, 1989, Corvallis, Oregon, pp. 4, 11.

[6] For a different approach, but one that results in a similar catch rate for boat fishers, see ICF Technology Incorporated, "Economic Impacts and Net Economic Values Associated with Non-Indian Salmon and Sturgeon Fisheries," A Report for the State of Washington, Department of Community Development, Redmond, Washington, March, 1988, p. A4. It includes this statement, "In the case of fresh water recreational salmon fishing, reliable estimates of daily catch rates were not available. On the basis of interviews with WDF (Washington Department of Wildlife) and ODF&W (Oregon Department of Fish and Wildlife) staff, a daily catch rate of .20 fish was used for up-river recreational salmon fishing."

[7] The IFG data indicate that fishing pressure on the Clearwater shifts to the Snake and Salmon rivers when runs and fishing conditions combine to produce poor catch rates, so angler days show more variability than catch rates. Angler days on the Clearwater varied from 19,304 to a high of 233,376. Low water years and smolt loss from epidemics may produce similar variations in fish runs and angler effort on the Yakima and Klickitat rivers.

[8] The former publication (The Research Group, "Final Report Survey and Economic Impact Analysis of the 1988 Willamette Run Spring Chinook Sport Fishery," Oregon Department of Fish and Wildlife, September, 1989, Corvallis, Oregon, pp. 4, 11.) was cited earlier (p. 51); the latter is Donnelly, Dennis M., et al. Net Economic Value of Recreational Steelhead Fishing in Idaho, Resource Bulletin, RM-9, U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment State, Fort Collins, Colorado, 1985.

[9] In an attempt to select the most appropriate expenditure figures for this study, we reviewed a wide variety of secondary data sources. For example, we evaluated data provided by the often used U.S. Department of the Interior, Fish and Wildlife Service, "1985 National Survey of Fishing, Hunting, and Wildlife Associated Recreation." It provides state level expenditure data, but these data are for either saltwater fishing or freshwater fishing in aggregate. Since we are concerned only with freshwater fishing for salmonid species, the National Survey data is not specific to for our purposes. We also reviewed a number of other studies that specifically estimate recreational expenditures for salmon and/or steelhead fishing. Some of them did not provide expenditure estimates for freshwater salmon or steelhead fishing while others did. None of them, however, contain data that are both as current and as useful as that provided by the "Survey and Economic Impact Analysis of the 1988 Willamette Run Spring Sports Fishery," published by the Oregon Department of Fisheries and Wildlife. These data are are roughly consistent with the inflation adjusted data of earlier studies, particularly the State of Washington, Department of Community Development study titled, "Economic Impact and Net Economic Values Associated with Non-Indian Salmon and Steelhead Fisheries."

[10] The latter accounts for less than 1% of total expenditures, but it does include a small undetermined amount of equipment rental expense. to offset this effect, all of the "other costs" (a category that also accounts for less than 1% of total expenditures) were included even though launching fees account for a small part of this expenditure category. Given the sample data upon which the adjustments are based, it could be argued that this type of fine tuning is more than can be justified; nevertheless, this kind of adjustment is defensible and was relatively easy to make.

[11] The 75% figure was arrived at by taking one-half of the "out-of-area" fishers' expenditure, (50% of 50%) and adding this 25% to the 50% percent of the "enroute" expenditures attributable to the recreationists who reside within the study area.

CHAPTER 6

OPERATION AND FINDINGS OF THE I/O MODEL

This chapter explains several operational adjustments of the I/O model and reports the indirect, induced, and total impacts indicated by the model. In reporting these findings, we emphasize the results of the REGION models. Findings for the KIYAK and RIVER models are discussed briefly. Complete tables, showing 525 sector impacts for each model, are presented as Appendix I.

Operational Adjustments

Chapter 5 describes direct inputs for the various KIYAK, RIVER, and REGION models, and we explain how adjusted expenditures related to construction to account for capacity availability factors. Tables 5.5 and 5.7 through 5.9 show direct expenditure inputs for operations and maintenance and for experimentation and monitoring. Several additional adjustments were made to the direct impact model beyond those described in Chapter 5. We margined direct impacts to the retail, wholesale, and services sectors for local incomes and profits in order to isolate and eliminate components of expenditures that have no multiplier effect on the local economy. For example, we margined retail sales to maintain only local value added, which resulted in most of the direct impact of retail trade being assigned to out-of-area producers. The margining tables are included in Appendix J as "Construction Model Margin Factors" and "Harvest Model Margin Factors."

We made additional adjustments to the "other wholesale" and "real estate" sectors. In the IMPLAN model, the low value of output per job in these sectors led to overestimation of employment change. We used national figures to re-estimate values for these sectors.

Findings: Construction Models

REGION CONSTRUCTION Model: Out-of-Area Contractor

During the first five years of the project, construction expenditures are the source of greatest impacts; operations and maintenance as well as experimentation and monitoring activities are secondary during this period.

Table 6.1 shows total output, income, and employment impacts for the REGION model under the assumption of outside contractors. The top half of the table shows total impacts over the five-year period, and the bottom half shows annualized impacts. For the five-year period, the project will create $43,765,673 in output, $20,184,282 in income and 645 units of employment.

The output measure of Table 6.1 and Figure 6.1 indicates that the construction sector is the most highly affected. However, in terms of employment, the service sector generates by far the largest number of jobs (229). The trade and FIRE (finance, insurance, and real estate) sectors

Table 6.1 Total Construction Period and Annual Construction Period Impacts; Out-of-Area Contractor, REGION Model. In 1989 **Dollars of Output and Income and in Units of Employment, for Major Sectors.**

Total Construction Period Impacts, 1990-1995

Sector	INDUSTRY OUTPUT	INCOME	EMPLOYMENT
AGRICULTURE, FORESTRY AND FISH	$427,959	$126,857	17
MINING	1,192,518	622,911	10
CONSTRUCTION	12,018,899	3,586,477	75
MANUFACTURING	6,835,040	2,221,155	61
TRANSPORTATION AND UTILITIES	2,868,763	1,529,584	38
TRADE	3,013,080	1,720,173	162
FIRE	3,328,833	2,133,710	87
SERVICES	11,876,371	6,985,440	229
GOVERNMENT	2,204,209	1,257,975	41
TOTAL	$43,765,673	$20,184,282	719

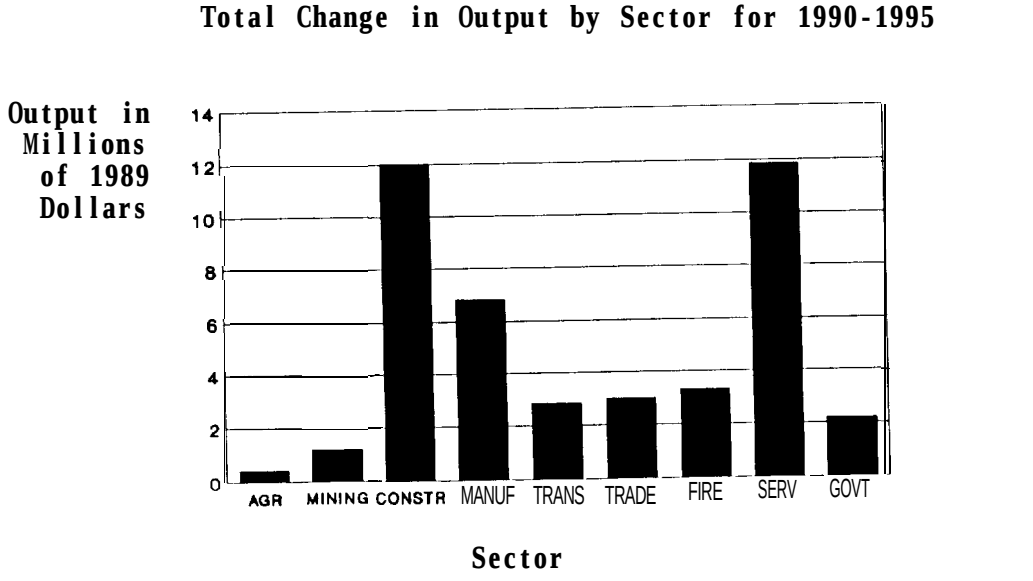
TOTAL DIRECT IMPACTS	$27,498,604
TOTAL INDIRECT AND INDUCED IMPACTS	$43,765,673
TOTAL IMPACTS	$43,765,673
MEAN MULTIPLIER EFFECT	1.59
MARGINED DIRECT IMPACTS	$27,476,630
GROSS MULTIPLIER	1.59

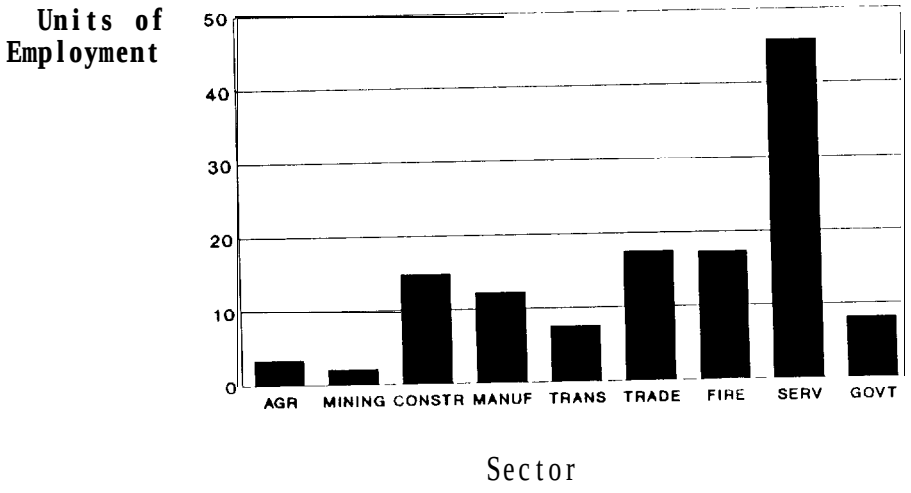
Annual Construction Period Impacts, 1990-1995

Sector	INDUSTRY OUTPUT	INCOME	EMPLOYMENT
AGRICULTURE, FORESTRY AND FISH	$85,592	$25,371	3
MINING	238,504	124,582	2
CONSTRUCTION	2,403,780	717,295	15
MANUFACTURING	1,367,008	444,231	12
TRANSPORTATION AND UTILITIES	573,753	305,917	8
TRADE	602,616	344,035	32
FIRE	665,767	426,742	17
SERVICES	2,375,274	1,397,088	46
GOVERNMENT	440,842	251,595	8
TOTAL	$8,753,135	$4,036,856	144

SOURCE: Computed with IMPLAN REGION model.

Figure 6.1. Construction Period Impacts by Sector for REGION Model--Out-of-Area Contractor.





Source: Calculated with IMPLAN REGION Model

both also generate more employment than construction during this phase. There are two complementary explanations for service, FIRE, and trade employment. First, these sectors are labor intensive while construction is capital intensive. Second, despite the large increases in output of the construction sector, its value added is about half that of the service sector per dollar of output. Thus, there are markedly lower induced effects originating from the construction sector. The increase in service jobs is sustained beyond the construction period, as most of the harvest period increases in employment also accrue to the service sector. The center portion of Table 6.1 shows the calculation of the aggregate multiplier from output data. Margined direct impacts of $27,476,630 result in total impacts of $43,765,673 (in a multiplier effect of 1.59).

Table 6.2 lists detailed IMPLAN sectors that experience the most impact during the 1990 through 1995 construction period. Consistent with Table 6.1, Table 6.2 shows that the output effects accrue primarily in the construction sectors, whereas income and employment effects accrue to the retail and service industries. Appendix I contains tables that present the impacts on the 525 IMPLAN sectors used in each of the IMPLAN models.

REGION CONSTRUCTION Model: Local Contractor

A variation of the REGION CONSTRUCTION model assumed that in-area contractors were the successful bidders. Although we have data that show the historic awards of contracts for passageway and screening work, we did not feel confident that past ratios of local/outside contractor awards would accurately reflect all of the construction required by this significantly larger project. Furthermore, bidding packages have not yet been designed, so that we could not estimate how attractive contracts would be to different contractors. Therefore, rather than use an expected value of the local to out-of-area contractor ratio, we ran a REGION model that assumes contracts will be awarded to in-region firms. By changing this assumption we determined the range of possible outcomes and the sensitivity of individual sectors to contract awards. This change in assumptions increased local construction expenditures markedly, as local contractors would use more locally obtained inputs (giving rise to wholesale margins and some local production) and more local subcontractors. Chapter 5 details the adjustments of these direct expenditures. Table 6.3 presents the impacts for the five-year construction period and for a typical year. Figure 6.2 graphically portrays the annualized broad sector data with the assumption of local contractor awards. All three impact measures show strong increases over the REGION model using out-of-area contractors (32% increase in the employment measure and 44% increase in the output measure). As would be expected, the greatest sensitivity to this change in assumption occurs in the construction sector itself, where all three impact measures approximately double. Table 6.4 presents detailed IMPLAN sectors that will experience the most impact under the assumption of a local contractor.

Table 6.2 IMPLAN Sectors Experiencing the Greatest Total Impacts, REGION **Model, Local Contractor, for Construction Period 1990-1995. <a>**

Implan #	Sector	INDUSTRY OUTPUT	INCOME	EMPLOYMENT
48	CONSTRUCTION SAND AND GRAVEL	$505,720	$250,325	4
66	NEW RESIDENTIAL STRUCTURES	625,614	195,032	8
67	NEW INDUSTRIAL AND COMMERCIAL	5,379,356	2,335,208	58
68	NEW UTILITY STRUCTURES	8,746,752	1,402,727	14
69	NEW HIGHWAYS AND STREETS	1,408,943	462,955	5
72	NEW GOVERNMENT FACILITIES	6,011,745	2,250,750	48
74	MAINTENANCE AND REPAIR	1,574,662	452,742	13
269	READY-MIXED CONCRETE	1,928,576	543,183	13
308	FABRICATED STRUCTURAL METAL	2,566,946	945,556	24
448	MOTOR FREIGHT TRANSPORT	719,493	409,482	11
453	ARRANGEMENT OF PASSENGER TRAN.	673,084	362,963	17
454	COMMUNICATIONS, EXCEPT RADIO	656,119	530,146	7
461	OTHER WHOLESALE TRADE	377,737	204,810	15
462	RECREATIONAL RELATED RETAIL	322,828	185,916	11
463	OTHER RETAIL TRADE	2,997,355	1,726,175	84
468	INSURANCE AGENTS AND BROKERS	916,425	580,325	14
470	REAL ESTATE	2,249,930	1,523,923	78
471	HOTELS AND LODGING PLACES	507,599	221,306	18
482	MANAGEMENT AND CONSULTING	3,012,478	1,972,140	58
489	ENGINEERING, ARCHITECTURAL	4,009,195	2,679,834	54
491	EATING AND DRINKING PLACES	1,510,546	552,595	43
493	AUTOMOBILE REPAIR AND SERVICES	966,226	408,555	8
503	DOCTORS AND DENTISTS	1,382,749	834,806	14
504	HOSPITALS	807,057	409,399	21
505	NURSING AND PROTECTIVE CARE	166,701	92,048	6
506	OTHER MEDICAL AND HEALTH	319,576	160,677	5
507	ELEMENTARY AND SECONDARY	92,702	42,762	7
511	LABOR AND CIVIC ORGANIZATIONS	95,400	39,767	8
515	SOCIAL SERVICES, N.E.C.	232,021	190,342	7
518	OTHER FEDERAL GOVERNMENT ENTER	895,622	542,549	13
521	OTHER STATE AND LOCAL GOVT	818,171	317,412	12
525	GOVERNMENT INDUSTRY	460,025	341,577	14

Source: Computed with IMPLAN REGION model.

<a> Output and income impacts are measured in 1989 dollars, employment in units.

Table 6.3 Total Construction Period and Annual Construction Period Impacts; Local Contractor, REGION Model. In 1989 **Dollars of Output and Income and in Units of Employment, for Major Sectors.**

Total Construction Period Impacts, 1990-1995

	INDUSTRY OUTPUT	INCOME	EMPLOYMENT
AGRICULTURE, FORESTRY AND FISH	$585,259	$173,560	24
MINING	1,227,124	641,032	11
CONSTRUCTION	23,808,606	7,138,825	146
MANUFACTURING	7,692,309	2,451,80	69
TRANSPORTATION AND UTILITIES	3,623,941	1,945,063	45
TRADE	3,844,259	2,196,247	111
FIRE	4,439,003	2,820,391	107
SERVICES	15,582,048	9,191,431	296
GOVERNMENT	2,585,005	1,456,601	48
TOTAL	$63,387,554	$28,014,955	856

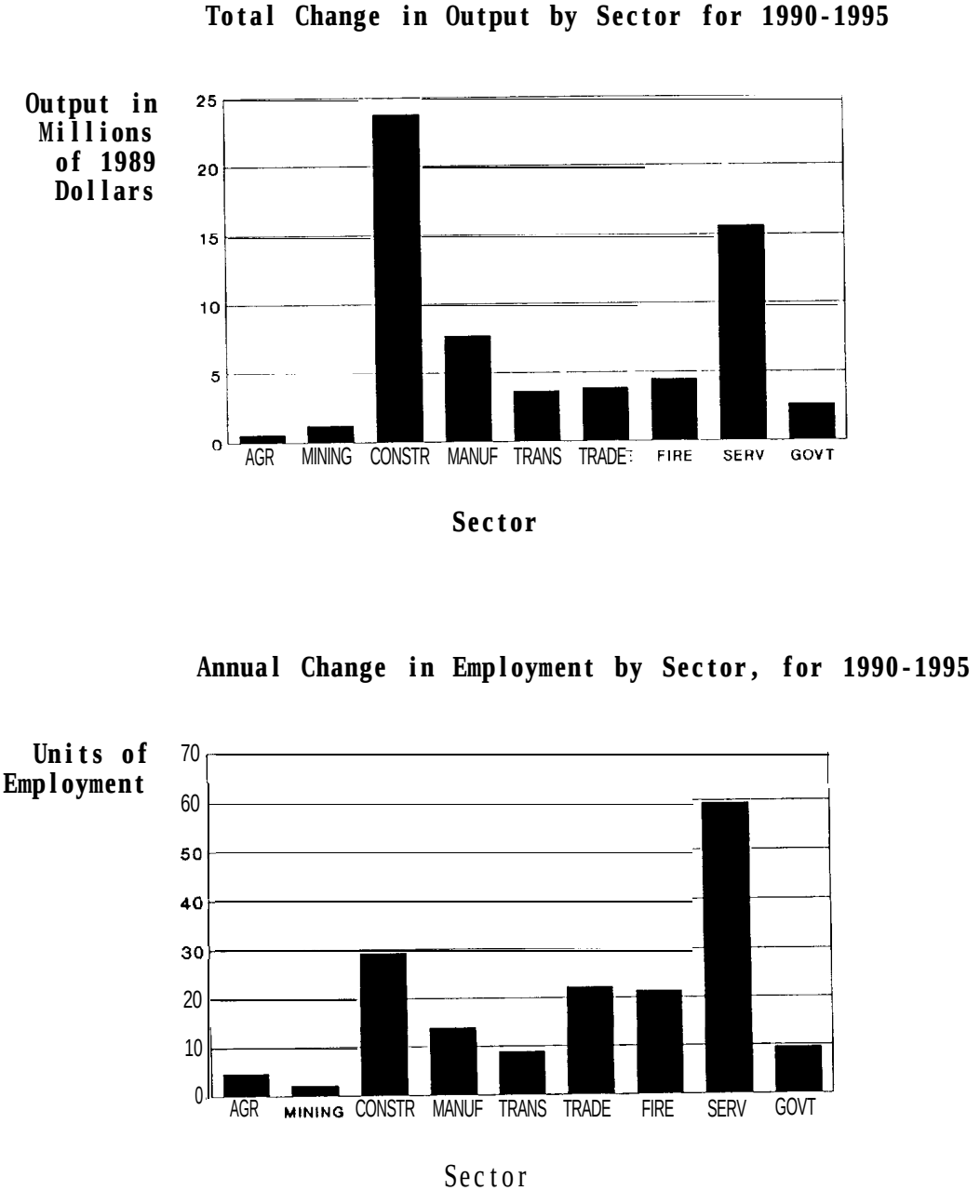
TOTAL DIRECT IMPACTS	$39,840,142
TOTAL INDIRECT AND INDUCED IMPACTS	$63,387,554
TOTAL IMPACTS	$63,387,554
MEAN MULTIPLIER EFFECT	1.59
MARGINED DIRECT IMPACTS	$39,816,758
GROSS MULTIPLIER	1.59

Annual Construction Period Impacts, 1990-1995

	INDUSTRY OUTPUT	INCOME	EMPLOYMENT
AGRICULTURE, FORESTRY AND FISH	$117,052	$34,712	5
MINING	245,425	128,206	2
CONSTRUCTION	4,761,721	1,427,765	29
MANUFACTURING	1,538,462	490,361	14
TRANSPORTATION AND UTILITIES	724,788	389,013	9
TRADE	768,852	439,249	22
FIRE	887,801	564,078	21
SERVICES	3,116,410	1,838,286	59
GOVERNMENT	517,001	291,320	10
TOTAL	$12,677,511	$5,602,991	171

Source: Computed with IMPLAN REGION model.

Figure 6.2. Construction Period Impacts by Sector for REGION Model--Local Contractor.



Source: Calculated with IMPLAN REGION Model

Table 6.4 IMPLAN Sectors Experiencing the Greatest Total Impacts, **REGION Model, Out-of-Area Contractor, for Construction Period** 1990-1995. <a>

Implan #	Sector	OUTPUT	INCOME	EMPLOYMENT
47	CRUSHED AND BROKEN STONE, N. E.	$697,456	$377,775	6
48	CONSTRUCTION SAND AND GRAVEL	492,495	243,779	4
66	NEW RESIDENTIAL STRUCTURES	625,614	195,032	8
67	NEW INDUSTRIAL AND COMMERCIAL	2,151,742	934,083	23
68	NEW UTILITY STRUCTURES	3,810,616	**611,113**	6
69	NEW HIGHWAYS AND STREETS	1,408,943	**462,955**	5
72	NEW GOVERNMENT FACILITIES	2,404,698	**900,300**	19
74	MAINTENANCE AND REPAIR	1,566,299	450,338	12
269	READY-MIXED CONCRETE	1,897,752	534,502	12
308	FABRICATED STRUCTURAL METAL	2,555,990	941,520	24
448	MOTOR FREIGHT TRANSPORT	513,653	292,333	8
453	ARRANGEMENT OF PASSENGER TRAN.	671,736	362,236	17
454	COMMUNICATIONS, EXCEPT RADIO	475,168	383,937	5
456	ELECTRIC SERVICES	504,625	228,213	2
463	OTHER RETAIL TRADE	2,276,220	1,310,874	64
470	REAL ESTATE	2,023,816	1,370,772	70
471	HOTELS AND LODGING PLACES	419,377	182,842	15
482	MANAGEMENT AND CONSULTING SERV.	2,974,175	1,947,065	58
489	ENGINEERING, ARCHITECTURAL	2,469,102	1,650,402	33
491	EATING AND DRINKING PLACES	1,148,784	420,253	33
493	AUTOMOBILE REPAIR AND SERVICES	778,781	329,297	7
503	DOCTORS AND DENTISTS	996,204	601,437	10
504	HOSPITALS	581,460	294,960	15
518	OTHER FEDERAL GOVERNMENT ENTER.	**817,069**	**494,963**	11
521	OTHER STATE AND LOCAL GOVT	597,198	231,685	9
525	GOVERNMENT INDUSTRY	460,025	341,577	14

Source: Computed with IMPLAN REGION model.

<a> **Output and income impacts are measured in** 1989 **dollars, employment in units.**

Other Construction Period Models

Tables 6.5 and 6.6 present parallel total impact data for the KIYAK and RIVER areas, respectively. The KIYAK area receives 75% of impacts because of the economic role of the Yakima area. Not only is Yakima County the site of 32% of the value of construction structures, but it is the hub of much of the construction and experimental expenditures of the entire study region. Similarly, as the distributive hub of the region, Yakima experiences large impacts in the wholesale and retail sectors. Detailed impacts by sector are presented in Appendix I for both the KIYAK CONSTRUCTION and RIVER CONSTRUCTION models. We observed the same pattern of impacts in the KIYAK model as in the REGION model. The construction sector dominates the impacts when the output measure is used (Table 6.5); yet the income and employment measures indicate that the predominant income changes are in the service sector, and the largest employment increases are in FIRE and services.

The RIVER area economy centers in The Dalles, Oregon, and is much smaller than that of KIYAK. The total population of the RIVER model area is 55,400, while the total population of the KIYAK model area is 209,000; the RIVER economy does not include many of the types of industries that are present in the KIYAK area. The importance of this difference is that the RIVER area imports a large number of goods and services. When new expenditures occur in the RIVER area, such as the construction expenditures associated with the fisheries enhancement project, much of the impact of these is lost due to the purchase of imports. For example, the RIVER area does not have a heavy construction industry (industrial, utility, and highway construction industry), so outside contractors will probably acquire many of the contracts for this work. Even if local contractors are successful, they may have to import a large quantity of their materials.

Harvest Models

REGION HARVEST Model

Table 6.7 and Figure 6.3 provide impact data for REGION during a maximum sustainable yield year; annual impacts are a $17,627,154 increase in output, an $8,507,806 increase in incomes, and 409 new jobs. Although the REGION harvest impact measured in output is twice the annual impact of the basic REGION construction model, employment is three times as large. This finding can be explained by the industry mix, as more harvest period expenditures are made in the labor intensive sectors. The more detailed sectors of Table 6.8 show that 82% of new employment accrues to the retail trade and the service sectors. Note that the different sectorial mix also results in a slightly higher aggregate multiplier of 1.62.

Other Harvest Models

KIYAK HARVEST. The development of a high quality anadromous fishery in close proximity to the Seattle metropolitan area has a significant impact

Table 6.5 Total Construction Period and Annual Construction Period Impacts; **Out-of-Area Contractor, KIYAK Model.** In 1989 **Dollars of Output and Income and in Units of Employment, for Major Sectors.**

Total Construction Period Impacts, 1990-1995

	INDUSTRY OUTPUT	INCOME	EMPLOYMENT
AGRICULTURE, FORESTRY AND FISH	$0	$58,673	3
MINING	901,122	446,184	
CONSTRUCTION	9,150,331	2,442,539	5:
MANUFACTURING	5,676,301	1,876,277	49
TRANSPORTATION AND UTILITIES	2,495,682	1,193,640	30
TRADE	2,054,151	1,175,110	59
FIRE	2,193,149	1,398,248	117
SERVICES	8,033,426	4,770,721	144
GOVERNMENT	1,928,863	1,031,659	29
TOTAL	$32,433,024.646	$14,393,050.148	491

TOTAL DIRECT IMPACT	$22,278,218
GROSS MULTIPLIER	1.47
TOTAL MARGINED IMPACTS	$22,278,218
TOTAL INDIRECT IMPACT	$10,390,887
TOTAL DIRECT & INDIRECT IMPACT	$32,669,106
TOTAL MULTIPLIER EFFECT	1.47

Annual Construction Period Impacts, 1990-1995

	INDUSTRY OUTPUT	INCOME	EMPLOYMENT
AGRICULTURE, FORESTRY AND FISH	$47,216	$11,735	1
MINING	180,224	89,237	1
CONSTRUCTION	1,830,066	488,508	10
MANUFACTURING	1,135,260	375,255	10
TRANSPORTATION AND UTILITIES	499,136	238,728	6
TRADE	410,830	235,022	
FIRE	438,630	279,650	::
SERVICES	1,606,685	954,144	29
GOVERNMENT	385,773	206,332	6
TOTAL	$6,533,821	$2,878,610	98

Source: Computed with IMPLAN KIYAK model.

Table 6.6 Total Construction Period and Annual Construction Period Impacts; Local Contractor, RIVER Model. In 1989 Dollars of Output and Income and in Units of Employment, for Major Sectors.

Total Construction Period Impacts, 1990-1995

	OUTPUT	INCOME	EMPLOYMENT
AGRICULTURE, FORESTRY AND FISH	$28,595	$5,354	1
MINING	194,078	60,318	2
CONSTRUCTION	2,193,331	776,417	24
MANUFACTURING	762,794	199,746	7
TRANSPORTATION AND UTILITIES	238,706	80,825	3
TRADE	451,353	208,006	13
FIRE	546,276	45,830	3
SERVICES	923,644	364,146	21
GOVERNMENT	153,285	59,913	3
TOTAL	$5,492,062	$1,800,554	76

TOTAL INDIRECT AND INDUCED IMPACT	$1,585,962
TOTAL DIRECT IMPACTS	$3,910,194
MEAN MULTIPIER	1.40
TOTAL MARGINED DIRECT	$3,906,100
GROSS MULTIPLIER	1.41

Annual Construction Period Impacts, 1990-1995

	OUTPUT	INCOME	EMPLOYMENT
AGRICULTURE, FORESTRY AND FISH	$5,719	$1,071	0
MINING	38,816	12,064	0
CONSTRUCTION	438,666	155,283	5
MANUFACTURING	152,559	39,949	1
TRANSPORTATION AND UTILITIES	97,741	46,165	1 4
TRADE	90,271	41,601	4
FIRE	109,255	9,166	1
SERVICES	184,729	72,829	4
GOVERNMENT	30,657	11,983	1
TOTAL	$1,098,412	$360,111	17

SOURCE: Computed with IMPLAN RIVER model.

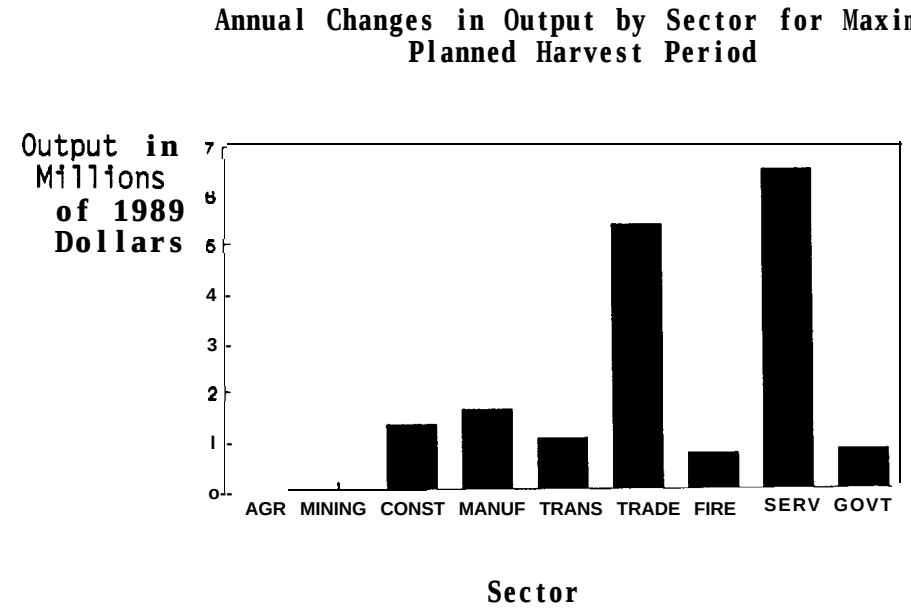
Table 6.7 Annual Harvest Period Impacts; REGION Model. In 1989 Dollars of Output and Income and in Units of Employment, for Major Sectors.

Sector	OUTPUT	INCOME	EMPLOYMENT
AGRICULTURE, FORESTRY AND FISH	$294,895	$84,654	9
MINING	6,940	3,492	0
CONSTRUCTION	1,327,198	373,995	10
MANUFACTURING	1,620,410	446,605	13
TRANSPORTATION AND UTILITIES	1,033,897	542,805	10
TRADE	5,361,487	3,060,823	156
FIRE	725,957	451,630	17
SERVICES	6,455,569	3,123,059	178
GOVERNMENT	800,802	420,742	15
TOTAL	$17,627,154	$8,507,806	409

TOTAL DIRECT IMPACTS	$10,906,145
TOTAL INDIRECT AND INDUCED IMPACTS	$9,139,711
TOTAL IMPACTS	$17,627,154
MEAN MULTIPLIER EFFECT	1.62
MARGINED DIRECT IMPACTS	$9,684,433
GROSS MULTIPLIER	1.82

SOURCE: Computed with IMPLAN REGION model.

Figure 6.3. Harvest Period Impacts by Sector for REGION **Model.**



Source: Calculated with IMPLAN REGION Model

Table 6.8 IMPLAN Sectors Experiencing the Greatest Total Impacts, REGION Model, for Harvest Period 1996-2015. <a>

Implan #	Description	OUTPUT	INCOME	EMPLOYMENT
1	DAIRY FARM PRODUCTS	$20,126	$4,495	6
74	MAINTENANCE AND REPAIR	1,211,601	348,356	10
433	SPORTING AND ATHLETIC GOODS	382,600	169,497	5
461	OTHER WHOLESALE TRADE	150,099	81,384	6
462	RECREATIONAL RELATED RETAIL	3,948,846	2,274,137	130
463	OTHER RETAIL TRADE	615,765	354,619	17
470	REAL ESTATE	345,471	233,995	12
471	HOTELS AND LODGING PLACES	2,012,432	877,390	72
491	EATING AND DRINKING PLACES	1,757,047	642,771	50
502	AMUSEMENT AND RECREATION SERVICE	351,168	194,356	12
521	OTHER STATE AND LOCAL GOVT	427,272	165,761	6

SOURCE: Computed with IMPLAN REGION model.

<a> Output and income impacts are measured in 1989 dollars, employment in units.

on the growing tourist related industries (hospitality industries) of Kittitas and Yakima counties. Parts of Kittitas County are already experiencing increased recreation and second home development as residents of the Puget Sound area seek recreational opportunities.

The development of an anadromous fishery increases the attraction of the area to Puget Sound residents. The majority of fishing activity for salmon and steelhead occurs during the fall and spring seasons, which are traditionally off seasons for the tourist industry. Some additional tourists can be accommodated without new facility construction. Table 6.9 summarizes the projected long term impacts of the project. The table includes the impacts of research and facilities maintenance, as well as continued experimentation and monitoring. The largest sectorial increases in activity occur in the trade and service sectors, where 82 and 86 jobs will be generated respectively for each year of maximum sustained yield harvest. As with the REGION HARVEST results, employment changes are more significant than changes in output and value added because the most affected sectors are labor intensive.

RIVER HARVEST. Fishing sites along the Columbia River and the lower Klickitat River are part of the recently designated Columbia Gorge National Scenic Area. The master plan that is being developed for the scenic area includes Congressional appropriations for a wide range of tourist facilities. The construction of these facilities, combined with increased fishing opportunities, greatly strengthens the local tourist economy. As the economy becomes more oriented towards tourist services, new businesses arise to supply the recreation and tourism industry. This reduces the leakage of tourist dollars from the local economy and increases project impacts.

The RIVER HARVEST model assumes that Native American fishing activity for both the Klickitat River and Yakima River runs will occur along the Columbia River. Consultation with Yakima Tribal fishing experts indicated that this was the most likely location for a large proportion of the Indian harvest. Indian harvest occurs in the Klickitat River (particularly in the vicinity of Klickitat Falls) and along the Columbia River.

Table 6.10 summarizes the results of the RIVER HARVEST model. Like the other models, the greatest of impacts occurs in the trade and service sectors. Because of the smaller size and fewer linkages of the RIVER economy, the aggregate multiplier of 1.26 is the smallest of the models. From the construction period to the harvest period, impacts shift toward the RIVER counties. Although the RIVER counties received only 13% of the region's construction period employment increases, in the HARVEST model they receive 22% of employment increases.

Other Model Results

Sensitivity Analysis. Sensitivity analyses were conducted by changing the magnitudes of key variables and then using these numbers to rerun the IMPLAN model for REGION. The reason for doing so is simply that the computation process has the potential to significantly magnify the impact of variations in any of a number of variables. (For a description of the computation procedure, see Chapter 5.) Some of these variables, for

Table 6.9 IMPLAN Sectors Experiencing the Greatest Total Impacts, KIYAK Model, for Harvest Period 1996-2015. <a>

Implan #	Description	OUTPUT	INCOME	EMPLOYMENT
461	**OTHER WHOLESALE TRADE**	$420,073	$227,765	17
462	**RECREATIONAL RELATED RETAIL**	2,007,788	1,156,280	69
463	**OTHER RETAIL TRADE**	**309,303**	**178,127**	**9**
470	**REAL ESTATE**	**162,388**	**110,471**	**13**
471	**HOTELS AND LODGING PLACES**	1,030,214	**479,935**	35
482	**MANAGEMENT AND CONSULTING**	307,307	200,841	5
491	**EATING AND DRINKING PLACES**	**869,930**	**318,242**	24
502	**AMUSEMENT AND RECREATION SERV.**	**173,932**	**96,264**	5
527	**HOUSEHOLD INDUSTRY**	**116,612**	**116,612**	11

SOURCE: Computed with IMPLAN KIYAK model.

<a> **Output and income impacts are measured in** 1989 **dollars, employment in units.**

Table 6.10 IMPLAN Sectors Experiencing the Greatest Total Impacts, RIVER **Model, for Harvest Period** 1996-2015. <a>

Implan #	Description	OUTPUT	INCOME	EMPLOYMENT
74	MAINTENANCE AND REPAIR	$276,802	$130,042	9
461	OTHER WHOLESALE TRADE	36,369	14,985	1
462	RECREATIONAL RELATED RETAIL TRADE	960,192	446,352	31
463	OTHER RETAIL TRADE	144,685	67,257	4
471	HOTELS AND LODGING PLACES	417,871	120,463	16
491	EATING AND DRINKING PLACES	423,404	122,755	11
502	AMUSEMENT AND RECREATION SERVICES	80,258	28,660	3

SOURCE: Computed with IMPLAN RIVER model.

<a> Output and income impacts are measured in 1989 dollars, employment in units.

example, planned sustainable harvest levels and the proportions of the harvest allocated to Indian and non-Indian fishers, have been exogenously determined. Others, like expenditures per trip, are based on recent research and are expected to be relatively stable over time. But two interrelated variables, catch rates and the proportion of fish harvested by boat and bank fishers, can only be considered rough approximations.[l]

We found that a 10% increase in catch rate causes total output (i.e., direct, indirect, and induced impacts) to decrease by 6.2%; a 25% increase in catch rate causes total impacts to decrease by 13.6%. (Note that the ratio of catch rate increase to total impacts decrease declines as the catch rate increases from 10% to 25%; i.e., it decreases from .62 to .54.) The basic reason for the direction of this change is that an increase in the catch rate reduces the number of trips required to harvest a fixed quantity of fish. This in turn reduces direct fishing expenditures. (Decreases in the catch rate were not analyzed because we see no reason why the planned increase in harvestable fish would result in lower catch rates per fishing trip.) In summary, it seems reasonable to conclude that, for the REGION model, an error in the catch rate estimate will result in less than a 10% overestimate of the total economic impact.

In general, total economic impacts are more sensitive to the boat/bank split than catch rate. For example, a 25% overall increase in boat fishers, with a simultaneous 25% decrease in bank fishers, causes a 19.4% decrease in total economic impacts. However, the major uncertainty in the boat/bank split data pertains to the steelhead boat/bank split. The salmon boat/bank split data shows relatively little variation over time and location. The steelhead boat/bank split varies significantly from river to river. Furthermore, interviews with Idaho Fish and Game Department personnel suggest that the boat/bank split for steelhead is changing over time as drift boat fishing becomes more popular. Thus, we went to an extreme and reversed the steelhead ratio of 80% boat and 20% bank. As a result, total output increased by 7.3%. The reason that the total output impact decreases in response to an overall increase in the proportion of boat-caught fish is that the resulting increase due to higher expenditures per boat trip (as compared to bank trip expenditures) is exceeded by the reduction in expenditures caused by the higher catch rate for boat fishers.

Overall, it is reasonable to conclude that the impact of errors in direct expenditure estimates are likely to be less than plus or minus 10%. And this assumes that catch rate and boat/bank split errors do not offset each other. If they do, the impact of potential errors in predicting these two variables could be as little as plus or minus 2%.

Sales Tax Analysis. Increase in final demand will also have impact upon sales tax revenue in each of the areas. The estimates for additional sales tax revenue by area and time period are

Model Area	Sales Tax Revenue
REGION HARVEST	$691,690.00
KIYAK HARVEST	$333,360.00
RIVER HARVEST	$151,933.00
REGION CONSTRUCTION	$587,970.00
KIYAK CONSTRUCTION	$353,950.00
RIVER CONSTRUCTION	$ 61,494.00

Further Considerations of Model Results

The static nature of the I/O models required that we interpolate the changes that the region's economy will undergo as the project moves from the base period to construction and finally into the harvest period. We also considered questions of dislocation and intersectorial shifts.

Many public works projects provide their greatest economic benefits to the local area during the construction phase, when large capital expenditures are required to build the project. This may create economic dislocation in the area due to the boom and bust cycle associated with construction. The fishery enhancement project is atypical of this pattern in that long term impacts are greater than the impacts experienced during the construction phase. During the first five years of the project, construction related expenditures are the primary source of new economic activity generated by the project. Expenditures linked to construction account for 79% of the impacts during this phase. Accounting for indirect and induced effects, the sector which experiences the most employment and income effects during the construction period is the service sector. This will lead to a relatively smooth transition into the harvest period, when the service sector will continue to generate the most new employment. Growth of employment and income will not suffer any marked sectorial shifts between phases.

The source of employment increases projected by the I/O models are commensurate with the changes that have occurred over the last decade at both the national and state levels. That is, 75% of new national employment and 80% of new Washington State employment have originated in the service sectors over this period (Cocheba and Mack, 1987). However, eastern Washington and non-metropolitan areas across the state have been lagging behind both the national and state metropolitan areas in terms of the rate of structural change. That is, as employment in primary industries has declined, employment in services has not grown commensurately. In this light, the project will generate needed jobs and somewhat accelerate the lags in structural transition. We will discuss the quality of new jobs in the concluding chapter.

It should again be noted that I/O analysis provides a "snapshot" of an economy for a period of time. In our analysis we have chosen two points in time, the construction period and the harvest period. The pictures which we have developed make no reference to the speed of transition. Clearly, there will be lags and surges, occasional overestimations and underestimations of business opportunities. The growth in retail and

service activities is particularly subject to disruptions, as both hesitations and overbuilding characterize the workings of our economy at the small business level. In the next chapter we will discuss the dynamics portrayed by the econometric model.

Notes

[1] We considered it important to determine how sensitive our impact estimates are to changes in certain key variables. The catch rate and boat/bank split variables are interrelated; catch rates used for boat fishers are approximately double those used for bank fishers. Furthermore, the historic catch rates upon which our estimates are based pertain to rivers that are similar but not identical to the Yakima and Klickitat rivers. And, finally, the planned changes in fish production are so large that any estimate of future catch rates and boat/bank splits for the Yakima or Klickitat rivers should only be viewed as rough approximations.

Chapter 7

Operation and Findings of the Econometric Model

This chapter explains how direct impacts are used as inputs into the econometric model and reports the results generated by the model. These findings complement the findings obtained by using the I/O model in three ways. First, the time dynamic is captured; estimates of total indirect and induced impacts change from year to year as levels of construction, operation and maintenance, experimentation and monitoring, and harvest vary. This complements the I/O estimates, which, although more sectorially detailed, are specified for a peak construction year and a peak harvest year. Second, the econometric findings include projected changes in income, total taxable sales, and total employment (as opposed to covered employment), which are not readily available in the I/O model output. Third, comparing the results of an econometric run on the KIYAK area with results obtained through the I/O model confirms the validity of the I/O estimates.

Direct Impacts

The direct impacts (expenditures for construction, operations and maintenance, experimentation and monitoring, and harvest) that are developed in Chapter 5 are the primary inputs into the econometric model. As explained in Chapter 3, we developed two econometric models. The first estimates impacts for the aggregate area comprised of the three counties (Yakima, Kittitas, and Klickitat) that will receive the preponderance of the direct impacts. This first run serves to estimate the indirect and induced impacts of the fishery enhancement project as well as the time dimension of these impacts. We developed the second model to validate the I/O model through comparison and used direct impacts for the aggregation of Yakima and Kittitas counties.

Table 7.1 shows the direct impacts over time that were used as inputs into the three-county run. For consistency, these direct impacts are noted by IMPLAN sector. Because the econometric model requires that time-series data be used as inputs, the direct impact data cover the period from 1990 to 2015. Developing this series from the direct impact data presented in Chapter 5 required several allocations of total expenditures. First, we divided the total hatchery construction expenditures evenly across the years 1992 through 1995, then divided Phase II screening and enhancement construction expenditures evenly across 1991 through 1995. Operations and maintenance activities phase in synchronously with the completion of each type of construction. Expenditures for experimentation and monitoring rise and then fall to a 1996 steady state. Fish harvest expenditures begin with the first returns in 1998 and increase linearly until the level of expenditures associated with maximum sustained yield are reached in 2015. As actual construction schedules are not yet fixed, we assumed a linear spending pattern was sufficiently accurate for purposes of running the econometric model. Similarly, given the biological uncertainties about

Table 7.1 Direct Impacts for the Aggregation of Yakima, Kittitas and Klickitat Counties, 1990-2015, in 1989 Dollars

Activity and Implan Number	1990	1991	1992	1993	1994	1995	1996	1997	1996	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2611	2012	2013	2014	2015	Total
						YEARS																					
Construction																											
47 Crushed Stone		39.742	160,160	1600,160	160.166	120.418																					640.641
48 Sand and Gravel		39,742	78.276	78,276	78.276	38.534																					313,10
66 Res. Structures			117.981	117,991	117,981	117,981																					471,92
67 Indust. Structures		453,638	775,103	775,103	775,103	321.465																					3,100,41
68 Utility Structures		410.265	1,060,644	1,060,644	1.060.644	650,379																					4,242,57
69 Highway and Street		134.460	338,399	336.399	338.399	203.919																					1.353.59
72 Govt. Facilities		129.609	786,482	788,482	788,482	658.873																					3,153,93
267 Concrete Block		19.975	100,251	100.251	100,251	80,276																					401,00
269 Ready-Mixed Conc.		199,106	439.943	439.943	439.943	240,837																					1,759,77
308 Fabricated Metals		584,288	584,288	584,288	584,288																						2,337,15
453 Travel Agency																											
461 Other Wholesale		7,606	7,606	7,606	7,606																						30,42
463 Other Retail		831	93,494	93,494	93,494	92,663																					373,97
468 Ins. Agents\Brok.			75,780	75,780	75,780	75,780																					303,11
470 Real Estate			145,527	145,527	145,527	145,527																					582,10
471 Hotels and Lodging																											
481 Computer Services		128,718	128,718	128,718	128,718																						514.871
489 Engineering\Arch. Serv.																											
491 Eat\Drink. Places																											
493 Auto Repair\Service																											
518 Fed. govt. Enter.		128,718	128,718	128,718	128,718																						514,871
Operations and Maintenance																											
Hatchery																											
74 Maint. and Repair							706,564	706,564	706,564	706,564	706,564	706,564	706,564	706,564	706,564	706,564	706,564	706,564	706,564	706,564	706,564	706,564	706,564	706,564	706,564	706,564	14,131,280
103 Prepared Feeds, N.E.C							542,953	542,953	542,953	542,953	542,953	542,953	542,953	542,953	542,953	542,953	542,953	542,953	542,953	542,953	542,953	542,953	542,953	542,953	542,953	542,953	10,859,050
461 Other Wholesale							138,162	138,162	138,162	138,162	138,162	138,162	138,162	138,162	138,162	138,162	138,162	138,162	138,162	138,162	138,162	1 3 8 .	1 6 2	138.162	138,162	138,162	2,763,240
463 Other Retail							41,783	41,783	41,783	41,783	41,783	41,783	41,783	41,783	41,783	41,783	41,783	41.783	41.783	41.783	41.783				41,783	41,783	835,665
520 St. and Loc. Utility							99,719	99,719	99,719	99,719	99.719	99,719	99,719	99,719	99,719	99,719	99,719	99,719	99,719	99,719	99,719	99,719	99.719 41,783	41.783 99,719	99,719	99,719	1,994,379
Phase II																											
74 Maint. and Repair		157,430	236,144	314,859	393,574	393,574	393,574	393,574	393,574	393,574	393,574	393,574	393,574	393,574	393,574	393,574	393,574	393,574	393,574	393,574	393,574	393,574	393,574	393,574	393,574	393,574	9,367,055
461 Other Wholesale		9,076	13,615	18,153	22,691	22,691	22,691	22,691	22,691	22,691	22,691	22.691	22,691	27,228	22.691	22,691	22.691	22,691	22,691	22,691	22.691	22.691	22,691	22,691	22,691	22,691	540,040
463 Other Retail		10,891	16,337	21,783	27,228	27,228	27,228	27,228	27,228	27,228	27,228	27,228	27,228	24,599	27,228	27,228	27,228	27,228	27,228	27,228	27,228	27,228	27,228	27,228	27,228	27,228	648,033
493 Auto Rep.\Service		9,840	14,759	19,679	24,599	24,599	24,599	24,599	24,599	24,599	24,599	24,599	24,599	[illegible]	24,599	24,599	24,599				24,599						585,450
520 St. and Loc. Utility		7,872	11,807	15,743	19,679	19,679	19,679	19,679	19,679	19,679	19,679	19.679	19,679	19,679	19.679	19.679	19.679	24,599	24,599	19,679	24,599	24,599	24,599	24,599	24,599	19,679	468,354
Enhancement																											
413 Mobile Homes		4,855	8,598	12,341	16,084	16,084	16,084	16,084	16,084	16,084	16,084	16,084	16,084	16,084	16,084	16,084	16,084	16,084	16,084	16,084	16,084	16,084	16,084	16,084	16,084	16,084	379,637
462 Recr. Retail		33,800	4,774	7,162	9,549	9,549	9,549	9,549	9,549	9,549	9,549	9,549	9,549	9,549	9,549	9,549	9,549	9,549	9,549	9,549	9,549	9,549	9,549	19,989	9,549	9,549	224,396
518 Fed. Govt. Enter.		1,767	63,534	85,302	114,539	114,539	114,539	114,539	114,539	114,539	114,539	114,539	114.539	114,539	114,539	114,539	114.539	114,539	114,539	114,539	114,539	114,539	114,539	114,539	114,539	114,539	2,701,992
520 St. and Loc. Utility		904	1,808	2.711	3,615	7,069	7,069	7,069	7,069	7,069	7,069	3,615	3,615 7,069	7,069	7,069	7,069	7.069	7,069	7,069	7,069	7,069	7,069	7,069	7,069	7,069	7,069	166,116
525 Govt. Industry						3,615	3,615	3,615	3,615	3,615	3,615			3,615	3,615	3,615	3,615	3,615	3,615	3,615	3,615	3,615	3,615	3,615	3,615	3,615	84,953
Experimentation and Monitoring																											
68 Utility Structures	90,941	90,941	55,829	55.829	55,829	55,829	47,131	47,131	47,131	47,131	47,131	47,131	47.131	47,131	47,131	47,131	47,131	47,131	47.131	47,131	47,131	47,131	47,131	47,131	47,131	47,131	1,347,818
365 Office Mach. N.E.C	86,515	86,515	53,113	53,113	53,113	53,113	44,838	44,838	44,838	44,838	44,838	44,838	44,838	44,838	44,838	44,838	44,838	44,838	44,838	44,838	44,838	44,838	44,838	44,838	44,838	44,838	1,282,230
450 Air Transportation	43,258	43,258	26,556	26,556	26,556	26,556	22,418	22,418	22.418	22,418	22,418	22,418	22,418	22,418	22,418	22,418	22,418	22,418	22,418	22,418	22,418	22,418	22,418	22,418	22,418	22,418	641,090
453 Travel Agency	160,450	160,450	98,502	98,502	98,502	98,502	83,156	83,156	83,156	83,156	83,156	83,156	83,156	83,156	83,156	83,156	83,156	83,156	83,156	83,156	83,156	83,156	83,156	83,156	83,156	83,156	2,378,017
462 Recr. Retail	19,661	19,661	12,069	12,069	12.069	12.069	10,169	10,189	10,169	10.189	10,189	10.189	10,189	10,189	10,189	10,189	10,189	10,189	10,189	10,189	10,189	10,189	10,189	10,189	10,189	10,189	291.373
463 Other Retail	54,859	54,859	33,678	33,678	33,678	33,678	28,430	28,430	28,430	28,430	28,430	28,430	28,430	28,430	28,430	28,430	28,430	28,430	28,430	28,430	28,430	28,430	28,430	28,430	28,430	28,430	813,033
470 Real Estate	41,567	41,567	25,519	25,519	25,519	25,519	21,542	21.542	21,542	21,542	21,542	21,542	21,542	21,542	21,542	21,542	21,542	21,542	21,542	21,542	21,542	21,542	21,542	21,542	21,542	21,542	616,052
471 Hotels and Lodging	58,986	58,986	36,211	36,211	36.211	36,211	30,569	30.569	30.569	30,569	30,569	30,569	30,569	30,569	30,569	30,569	30,569	30,569	30,569	30,569	30,569	30,569	30,569	30,569	30,569	30,569	874,193
482 Mgmt.\Consult. Serv.	660,676	660,676	404,138	404,138	404,136	404,138	345,941	345,941	345,941	345,941	345,941	345,941	345,941	345,941	345,941	345,941	345,941	345,941	345,941	345,941	345,941	345,941	345,941	345,941	345,941	345,941	9,856,728
489 Engineering\Arch. Serv	254,832	254,832	156.446	156,446	156,446	156,446	132,071	132,071	132,071	132,071	132,071	132,071	132,071	132,071	132,071	132,071	132,071	132,071	132,071	132,071	132,071	132,071	132,071	132,071	132,071	132,071	3,776,860
491 Eat\Drink. Places	35,390	35,390	21.728	21,728	21,728	21,728	18,340	18,340	18,340	18,340	18,340	18,340	18,340	18,340	18,340	18,340	18,340	18,340	18,340	18,340	18,340	18,340	18,340	18,340	18,340	18,340	524,490
492 Auto Rental\Leasing	78,650	78,650	82,034	82,034	82,034	82,034	40,761	40,761	40,761	40,761	40.761	40,761	40,761	40,761	40,761	40,761	40,761	40,761	40,761	40,761	40,761	40,761	40,761	40,761	40,761	40,761	1,300,660
Harvest																											
433 Sporting Goods							13.098	15.436	18.192	21,441	25,269	29.781	35,098	41.365	48,750	57,455	67,713	79,804	94,053	110,846	130,637	153,963	181,453	213.651	1,338,204
462 Recr. Retail							166,585	196,329	231,384	272,697	321,387	378,771	446,401	526,106	620,043	730,751	861,227	1,015,000	1,196,229	1,409,816	1,661,539	1,958,207	2,307,846	2,719,913	17,020,231
471 Hotels and Lodging							72,038	84,901	100,060	117.926	138,982	163.797	193,043	227,511	268,133	316,008	372,431	438,929	517,300	609,664	718,520	846,812	998,010	1,176,205	7,360,269
484 Equip. Rep.\Leas.							1.284	1,514	1,784	2,102	2,478	2.920	3.441	4,056	4,780	5,633	6,639	7,825	9,222	10,869	12.809	15,096	17,792	20.968	131,212
491 Eat\Drink. Places							59,107	69,661	82,099	96,758	114,034	134,394	158.391	186,671	220,001	259,283	305,578	360,139	424,442	500,226	589,542	694,805	818,862	965,070	6,039,062
499 Comm. Sports							12,385	14,596	17,202	20,274	23,893	28,160	33.188	39,113	46,097	54.328	64,028	75,460	88,933	104,812	123,527	145,582	171,576	202,211	1,265,364
521 Other St.\Loc. Enter.							2,158	2,543	2,997	3,532	4,163	4,906	5,782	6,814	8.031	9,465	11,155	13,146	15,494	18,260	21,520	25,363	29,891	35,228	220,446
Totals	1,585,784	4,101,325	6,401,283	6,534,551	6,667,819	4,391,100	2.993.191	2.993.191	3,006,288	3.008.627	3,011,383	3.014.631	3.018.459	3,022,971	3,028,288	3,034,555	3,041,941	3,050,645	3,060,904	3,072,994	3,087,243	3,104,036	3,123,828	3,147,153	3,174,643	3,207,042	

Source: Derived from information presented in Tables 5.2-5.9.

fish returns and harvest regulations, we assumed that a linear increase in harvest-related expenditures was the most defensible.

Table 7.2 presents parallel direct expenditure data used in the KIYAK run. A further breakdown of time expenditures along with a list of assumptions for expenditure patterns in individual counties is included in Appendix K.

As noted earlier, the econometric model Is employment driven. We converted the direct impacts presented in Tables 7.1 and 7.2 into employment equivalents using the output to employment ratios incorporated in IMPLAN. Since employees in different sectors receive different wages, direct employment impacts in each sector were multiplied by the ratio of average wages in the sector to average wages in the regional economy. The adjusted direct employment impacts by sector were then aggregated to estimate the total direct impacts on the region attributable to the proposed fishery enhancement project.

We also calculated the direct impacts of increased regional employment on total income and total taxable sales. The direct impacts on total income were developed by multiplying the average wage in the regional economy by the total direct employment impacts in the region. The direct impacts on total taxable sales were estimated by multiplying the fraction of each extra dollar in regional income spending on total taxable sales by the direct impacts on total income.

Estimates are presented for both total and covered employment, total income, and total taxable sales. (The term "covered employment" refers to employment of individuals "covered" by Washington State's disability and unemployment insurance programs.) All dollar figures are in 1989 dollars. While the econometric model is primarily a covered employment model, the data do allow estimating the relationship between covered employment and Employment Security's estimate of total employment. Total employment is, on average, about 20% higher than covered employment. Since total employment is estimated after covered employment, we provide no direct or indirect and induced impacts for total employment.

Findings of the Econometric Model

The econometric model results are broken down into three categories: total impacts, direct impacts, and combined indirect and induced impacts. The definition and nature of these impacts are the same as those discussed in Chapter 3 for the input-output model. In contrast to the detailed results of IMPLAN, the econometric model results are restricted to aggregate measures of total and covered employment, total income, and total taxable sales in the region.

The total, direct, and indirect and induced impacts for the years 1990 through 2015 are given in Tables 7.3-7.5, respectively. These impacts change by year as the direct impacts increase or decrease over time. For example, Table 7.3 shows the total estimated impacts. In 1993, a typical year of the project construction, a total of 161 jobs are generated; 130 of these are covered employment. These employment impacts can be broken down

Table 7.2 Direct Impacts for the Aggregation of Yakima and Kittitas Counties, 1990-2015

Implan #	Description	1990	1991	1992	1993	1994	1995	19%	1997	1998	1999	2000	2001	2002	2003	2004	2003	2006	2007	2008	2009	2010	2011	2012	2013	2014	20:15	Total
construct ion																												
47	Crushed Stone		36.677	114,906	114,906	114,906	78,229																					459,62
48	Sand and Gravel		36.677	61,710	61,710	61,710	25,033																					246.84
66	Res. Structures			87,851	87,851	87,851	87.851																					331.40
67	Indust. Structures		439,642	726,792	726,792	726.792	287,150																					2,907,16
68	Utility structures		397,762	929,554	929,334	929,554	531,793																					3.718.21
69	Highway and Street		123,832	174,169	174.169	174.169	50,337																					696.67
72	Govt. Facilities		125,616	677: 157	677,157	677.157	551,541																					2,708,62
267	Concrete Block		18,378	70,529	70,329	70.329	32,151																					282.11
269	Ready-Mixed Conc.		183,457	339,914	339.914	339.914	136,458																					1,359;65
308	Fabricated Metals		581,545	581,545	581,543	581,545																						2,326,18
453	Travel Agency																											
461	Other Wholesale		7,371	7,371	7,371	7.371																						29,48
463	Other Retail					66,198	65,489																					264.79;
468	Ins. Agents\Brok.		709	66,198	68,298	72,215	72.215																					288,85
470	Real Estate			114,401	114.401	114,401	114.401																					457,60
471	Hotels and Lodging																											
481	Computer Services		128,718	128,718	128,718	128,718																						514,871
489	Engineering\Arch. Serv.																											
491	Eat\Drink. Places																											
493	Auto Repair\Service																											
518	Fed. govt. Enter.		128,718	128,718	128,718	128,718																						514,871
Operations and Maintenance																												
Harvest																												
74	Maint. and Repair							493.833	493,833	493,835	493,833	493,833	493,833	493,835	493,835	493,835	493,835	493,835	493,835	493,835	493,835	493,835	493,835	493,835	493,835	493,835	493,835	9,876,700
103	Prepared_ Feeds, N.E.C							379,483	379,483	379.183	379,483	379,483	379,483	379,483	379,483	379,483	379,483	379,483	379,483	379,483	379,483	379,483	379,483	379,483	379,483	379,483	379,433	7,589,650
461	Other Wholesale							40.073	40.073	40.073	40,073	40,073	40,073	40,073	40,073	40,073	40,073	40,073	40,073	40,073	40,073	40,073	40,073	40,073	40,073	40,073	40,073	801,436
463	Other Retail							76.3%	76.366	76.366	76,366	76,366	76,366	76,366	76,366	76: 366	76,366	76,366	76,366	76,366	76,366	76,366	76,366	76,366	76,366	76,366	76,366	1,527,320
520	St. and Loc. Utility							96,565	96,565	96,363	96.363	96,565	96.365	96,363	96.363	96.363	96,565	96,565	96,565	96,565	96,565	96,565	96,565	96,565	96,565	96,565	96.565	1,931,300
Phase II																												
74	Maint. and Repair		157,430	236,144	314,859	393,574	393,574	393,574	393,574	393,574	393,574	393,574	393,574	393,574	393,574	393,574	393,574	393,574	393,574	393,574	393,574	393,574	393,574	393,574	393,574	393,574	393,574	9,367,055
461	Other Wholesale		10,891	16,337	21,783	27,228	27,228	27,228	27,228	27,228	27,228	27,228	27,228	27,228	22,691	22,691	27.228	27,228	27.228	22,691	27.228	27.228	27.228	27.228	27.228	27.228	27.228	648.032
463	Other Retail		9,076	13,615	18,153	22,691	22,691	22,691	22,691	22,691	22,691	22,691	22,691	22,691												22,691	22,691	340,046
493	Auto Rep.\Service		7,872	11,807	15,743	19,679	19,679	19.679	19,679	19,679	19,679	19,679	19,679	19,679	19.679	19,679	19,679	19,679	19,679	19,679	19,679	19,679	19,679	19,679	19,679	19,679	19.679	468.334
520	St. and Loc. Utility		9,840	14.739	19,679	24,399	24,399	24,399	24,599	24,599	24,599	24,599	24,599	24,599	24,399	24,399	24,399	24.599	24,399	24,399	24,599	24,399	24,399	24,399	24,399	24,399	24,599	383,430
Enhancement																												
413	Mobile Homes		904	1.808	2,711	3,613	3.613	3.613	3,613	3.613	3,613	9,549	3,613	3.613	9,549	3.613	3.613	3.613	3.613	3.613	3.613	3.613	3.613	3.613	3.613	3,613	3.615	04,933
462	Recr. Retail		2,387	4,774	7,162	9,349	9,549	9.349	9,349	9,349	9,349	7,069	9,349	9,349	7,069	9,349	9,349	9,349	9,349	9,349	9,349	9,349	9,349	9,349	9,349	9,349	9,54	224,396
518	Fed. Govt. Enter.		1.767	3,334	3.302	7.069	17,069	14.971 7,069	14,971 7,069	14,971 7,069	14,971 7,069	14,971	14,971 7,069	14,971 7,069	14,971	14,971 7,069	14,971 7,069	14,971 7,069	14,971 7,069	14,971 7,069	14,971 7,069	14,971 7,069	14,971 7,069	14,971 7,069	14,971 7,069	14,971 7,069	17,069	166.116
520	St. and Loc. Utility		3,743	7.486	11,228	14,971																					1	331,824
525	Govt. Industry		26,913	33,826	80,738	107,651	107.631	107,631	107,651	107,631	107,631	107,631	107,631	107,651	107,631	107,651	107,651	107,651	107,651	107,651	107.631	107,631	107.631	107.631	107,631	107,631	107,651	2,529,804
Experimentation and Monitoring																												
68	Utility Structures	83,665	83,665	31,363	31,363	31,363	51,363	43.361	43.361	43.361	43,361	43,361	43,361	43,361	43,361	43,361	43,361	43.361	43,361	43,361	43,361	43,361	43,361	43.361	43,361	43,361	43.36	1,239,996
365	Office_ Mach. N.E.C	73,539	73,539	43.146	45,146	43.146	43.146	38.113	38,113	38,113	38,113	38.113	38.113	38.113	38,113	38,113	38,113	38,113	38,113	38,113	38,113	38,113	38,113	38,113	38,113	38,113	38,113	1,089,913
450	Air Transportation	43,258	43,258	26,356	26,556	26,336	26.336	22.418	22,418	22,418	22,418	22.418	22,418	22,418	22,418	22,418	22,418	22,418	22,418	22,418	22,418	22,418	22,418	22,418	22,418	22,418	22,418	641,090
433	Travel Agency	156,675	156,675	96.184	96,184	96,184	96.184	81,199	81,199	81,199	81,199	81,199	81,199	81,199	81,199	81,199	81,199	81,199	81,199	81,199	81,199	81,199	81,199	81,199	81,199	81,199	81,199	2,322,067
462	Recr. Retail	15,729	15,729	9.663	9.633	9,633	9,633	8.131	a. 131	8,131	8,131	8.131	8.131	8.131	8.131	8.131	8.131	a. 151	8.131	8,151	8,151	8.131	8.151	8.131	8.131	8.131	8,151	233,103
463	Other Retail	47,781	47,781	29,333	29,333	29,333	29,333	24,762	24.762	24,762	24,762	24,762	24,762	24,762	24; 762	24,762	24,762	24,762	24,762	24,762	24,762	24,762	24,762	24,762	24,762	24,762	24,762	708.137
470	Real Estate	39,090	39,090	23,998	23,998	23.9%	23.998	20,236	20.238	20,238	20.238	20.258	20.238	20.258	20,258	20,258	20,238	20,258	20,258	20,258	20,238	20,258	20,238	20,258	20,258	20.238	20,258	379,334
471	Hotels and Lodging	47.189	47.189	28.969	28.969	28,969	28,969	24,433	24,433	24,433	24,453	24,453	24,433	24; 433	24,433	24,433	24,433	24,433	24,433	24,433	24,433	24,435	24,433	24,433	24,433	24,453	24,455	699,333
482	Mgmt.\Consult. Serv.	528.341	328.341	323,018	323,018	323,018	323,018	277,460	277,460	277,160	277,460	277,460	277,460	277,460	277,460	277,460	277,460	277,460	277,460	277,460	277,460	277,460	277,460	277,460	277,460	277.460	277,460	7,898,333
489	Engineering\Arch. Serv	254,046	254,046	155,964	155,964	133.964	155,964	131,663	131,663	131.663	131.663	131,663	131,663	131,663	131,663	131,663	131,663	131,663	131,663	131,663	131,663	131,663	131.663	131.663	131,663	131,663	131,663	3, 763,203
491	Eat\Drink. Places	28.313	28,313	17,383	17,383	17,383	17,383	14.673	14.673	14.673	14,673	14,673	14,673	14.673	14,673	14.673	14,673	14,673	14,673	14,673	14,673	14.673	14,673	14,673	14,673	14.673	14,673	419,603
492	Auto Rental\Leasing	66,853	66,853	74,791	74,791	74,791	74,791	34.648	34,648	34,648	34,648	34,648	34,640	34; 648	34.648	34,648	34,648	34,648	34,648	34,648	34,648	34.648	34,648	34,648	34,648	34,648	34,648	1, 123,820
Harvest																												
433	Sporting Goods							11,939	14,071	16,583	19,344	23,034	27.147	31.994	37.706	44.438	32,373	61,724	72,743	83,734	101.042	119,083	140.343	165,403	194,936	1,219,840
462	Recr. Retail							110,843	130,634	153,959	181.448	213,846	232.028	297.028	350,062	412,566	486.230	573,046	675,364	793,930	938.067	1,105,560	1,302,958	1,535,602	1,809,784	11,321,677
471	Hotels and Lodging							31.199	60,341	71,115	83.813	98,777	116,414	137.200	161,697	190,568	224,594	264,696	311,957	367.637	433.303	310.669	601.849	709,309	833.957	3.2131,116
484	Equip. Rep.\Leas.							977	1.132	1,358	1,600	1,886	2,222	2,619	3.087	3.638	4.288	5.033	3.956	7,019	a.272	9,749	11,490	13,542	13.960	99,869
491	Eat\Drink. Places							41,987	49,484	11,868	68.732	81,004	95,467	112,513	132,602	156,279	184,182	217,068	233,826	301,503	355,337	418,782	493,556	581,681	683,340	4,289,864
499	Comm. Sports							8,544	10.070	2.062	13,987	16,484	19,428	22,897	26,985	31,803	37,481	44,174	32.061	61,356	72,312	83,223	100.440	118,373	139.309	6172,993
521	Other St.\Loc. Enter.							1,483	1,730	,	2,431	2,865	3,376	3,979	4,690	5,527	6,514	7,677	9,047	10,663	12,567	14,811	17,433	20.372	24,243	131,714
		1,384,676	3,824,598	5,528,197	5,661,465	5,794,733	3,585,632	2,438,106	2,438,106	2,665,081	2,705,608	2,753,370	2,809,661	2,876,002	2,954,189	3,046,335	3,154,935	3,282,925	3,433,768	3,611,544	3,821,062	4,067,989	4,359,005	4,701,982	5,106,198	5,582,587	6,144,036

Source: Derived from information presented in Tables 5.2-5.9.

Table 7.3 Total Impacts for Three-County Area, 1990-2015. <a>

Year	Total Employment	Covered Employment	Income	Total Taxable Sales
1990	38	31	$748,840	$188,640
1991	98	79	1,915,160	482,480
1992	142	115	2,790,160	702,620
1993	161	130	3,156,400	795,180
1994	176	142	3,438,400	866,100
1995	164	132	3,196,800	805,240
1996	137	110	2,680,960	675,200
1997	133	107	2,598,640	654,620
1998	147	118	2,872,120	723,460
1999	165	133	3,216,800	810,400
2000	184	148	3,597,160	906,120
2001	204	165	3,996,640	1,006,740
2002	225	182	4,407,000	1,110,000
2003	247	199	4,823,960	1,214,820
2004	268	216	5,244,640	1,321,160
2005	290	233	5,667,120	1,427,540
2006	312	251	6,091,360	1,534,240
2007	333	268	6,516,480	1,641,500
2008	355	286	6,941,960	1,748,520
2009	377	304	7,367,640	1,855,860
2010	399	321	7,793,520	1,963,240
2011	420	339	8,220,000	2,070,400
2012	442	356	8,646,160	2,177,900
2013	464	374	9,072,280	2,285,160
2014	486	391	9,498,880	2,392,620
2015	508	409	9,925,200	2,500,000

Source: Computed with econometric model.

<a> Total impacts measured in units of total employment and covered employment, 1989 dollars of income and taxable sales.

Table 7.4 Direct Impacts for Three-County Area, 1990-1995. **<a>**

Covered Employment	Real Income	Total Taxable Sales
25	$404,594	$101,909
59	966,568	243,459
80	1,311,229	330,272
85	1,385,720	349,035
89	1,460,211	367,798
78	1,273,862	320,860
61	995,775	250,816
61	995,775	250,816
71	1,164,925	293,421
82	1,334,075	336,027
92	1,503,225	378,632
102	1,672,375	421,238
113	1,841,525	463,843
123	2,010,675	506,449
133	2,179,826	549,054
144	2,348,976	591,660
154	2,518,126	634,266
164	2,687,276	676,871
175	2,856,426	719,477
185	3,025,576	762,082
195	3,194,726	804,688
206	3,363,877	847,293
216	3,533,027	889,899
226	3,702,177	932,504
237	3,871,327	975,110
247	4,040,477	1,017,715

Source: Computed with econometric model.

<a> Total impacts measured in units of total employment and covered employment, 1989 **dollars of income and taxable sales.**

Table 7.5 Indirect and Induced Impacts for Three-County Area, 1990-2015. <a>

Covered Employment	Real Income	Total Real Taxable Sales
6	$344,246	$86,731
20	948,592	239,021
35	1,478,931	372,348
45	1,770,680	446,145
52	1,978,189	498,302
54	1,922,938	484,380
50	1,685,185	424,384
46	1,602,865	403,804
47	1,707,195	430,039
51	1,882,725	474,373
56	2,093,935	527,488
62	2,324,265	585,502
69	2,565,475	646,157
76	2,813,285	708,371
83	3,064,814	772,106
90	3,318,144	835,880
97	3,573,234	899,974
104	3,829,204	964,629
111	4,085,534	1,029,043
119	4,342,064	1,093,778
126	4,598,794	1,158,552
133	4,856,123	1,223,107
140	5,113,133	1,288,001
147	5,370,103	1,352,656
155	5,627,553	1,417,510
162	5,884,723	1,482,285

Source: Computed with econometric model.

<a> Total impacts measured in units of total employment and covered employment, 1989 dollars of income and taxable sales.

into direct as well as indirect and induced effects. Tables 7.4 and 7.5 show that of the 130 covered jobs created in 1993, 85 are the result of direct expenditures. The additional 45 covered jobs are generated by the recirculation of the initial impacts within the local economy.

Impacts measured in terms of the other variables, income and taxable sales, are presented in a parallel manner in Tables 7.3-7.5. Total impacts are shown in Table 7.3; these are, in turn, broken down into the direct component (Table 7.4) and the indirect and induced components (Table 7.5). For example, the initial year of the project generates $748,840 of additional total income in the three-county area. Of this amount, $404,594 is produced directly and the remaining $344,246 is created during the multiplier process. Similarly, in the first year, total taxable sales increase by $188,640, $101,909 of which are direct impacts and $86,731 are indirect and induced impacts. Table 7.6 shows the impact multipliers for each year of the project and for all four impact variables: total employment, covered employment, real income, and taxable sales. Each multiplier summarizes the relationship between direct and total impacts. Because the model is linear, the multiplier of total sales is identical to the income multiplier.

As illustrated in Figures 7.1-7.4, levels and increases in employment, income, and sales in the region vary markedly over the sample period. Two rather distinct phases of the project are evident from the graphs. The first phase, from 1990 to 1997, includes the construction of the fish hatchery and the activity levels immediately after completion of construction, when residual construction spending is still circulating through the regional economy. Experimentation and monitoring expenditures are also important during this period, and operations and maintenance expenditures are slowly being phased in as the screening work and eventually the hatchery becomes operational. Note that the multipliers peak in 1996, even though direct expenditures peak in 1994. This difference is explained by the dynamics of the model; that is, continued iterations of spending drive the multiplier upwards, while direct expenditures are falling from their 1994 peak.

Beginning in 1997 and continuing until 2015, the second phase initially reflects the impacts of operations and maintenance, experimentation, and monitoring activities. Harvest expenditures begin in 1998 and the associated impacts increase linearly until maximum sustained yield is reached in 2015. At the end of the study period, 2015, total employment has grown to 508 jobs, of which 409 represent covered employment.

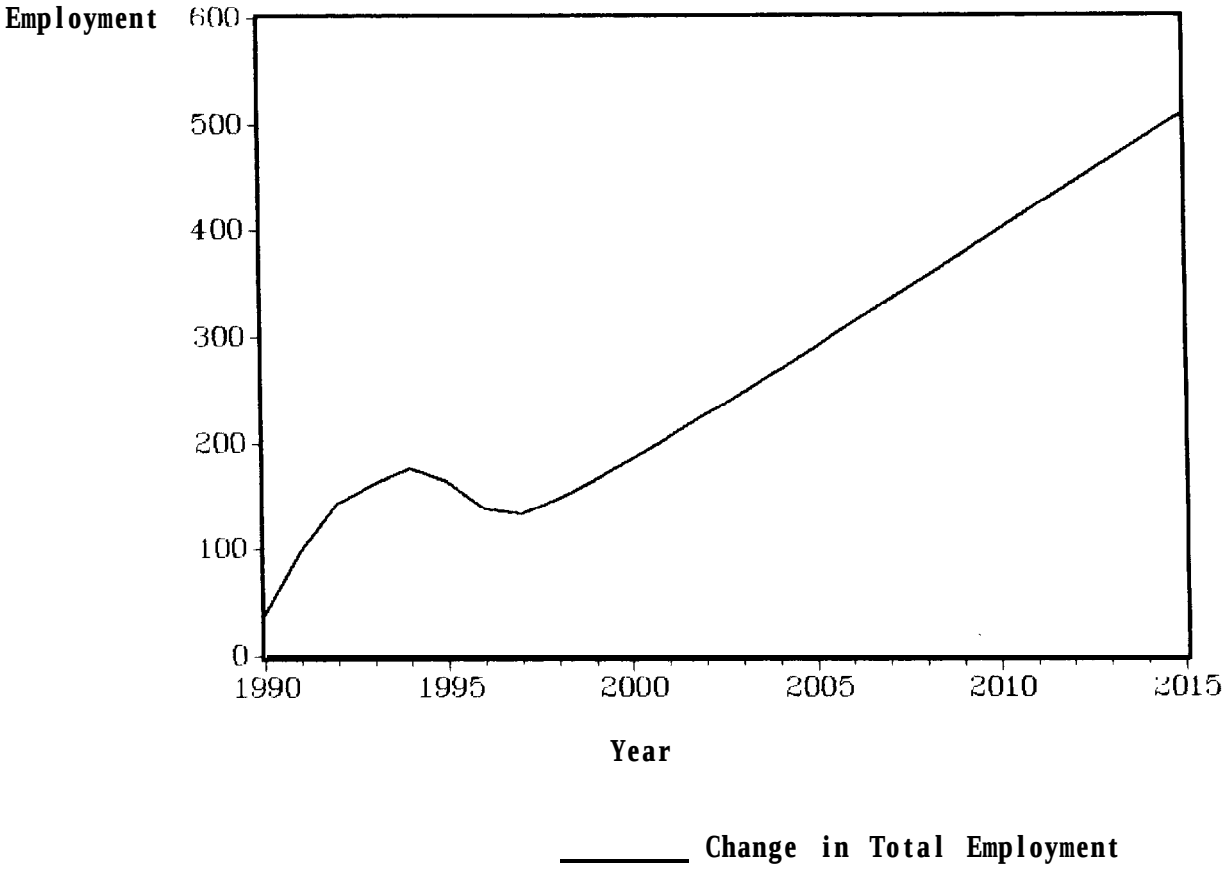
The employment, income, and sales multipliers demonstrate some of the time dynamics captured by the econometric model. The recirculation of income and spending in the local economy takes time. In the first year of the project, the total employment multiplier is only 1.5. As the construction, experimentation, and operatlon and maintenance impacts accelerate between 1991 and 1994, the employment multiplier also increases. However, the multiplier does not reach its maximum level of 2.3 until two years after the construction phase peak of direct impacts.

Table 7.6 Impact Multipliers for Total Employment, Covered Employment, Income and Taxable Sales, for Three-County Area, 1990-2015.

Year	Total Employment	Covered Employment	Income	Total Taxable Sales
	1.5	1.2	1.9	1.9
1991	1.7	1.3	2.0	2.0
1992	1.8	1.4	2.1	2.1
1993	1.9	1.5	2.3	2.3
1994	2.0	1.6	2.4	2.4
1995	2.1	1.7	2.5	2.5
	2.3	1.8	2.7	2.7
1996	2.2	1.8	2.6	2.6
1997	2.1	1.7	2.5	2.5
1999	2.0	1.6	2.4	2.4
2000	2.0	1.6	2.4	2.4
2001	2.0	1.6	2.4	2.4
2002	2.0	1.6	2.4	2.4
	2.0	1.6	2.4	2.4
2003	2.0	1.6	2.4	2.4
	2.0	1.6	2.4	2.4
2005	2.0	1.6	2.4	2.4
	2.0	1.6	2.4	2.4
2007	2.0	1.6	2.4	2.4
2009	2.0	1.6	2.4	2.4
2010	2.0	1.6	2.4	2.4
2011	2.0	1.6	2.4	2.4
2012	2.1	1.7	2.4	2.4
2013	2.1	1.7	2.5	2.5
	...	...	2.5	2.5
2015	2.1	1.7	2.5	2.5

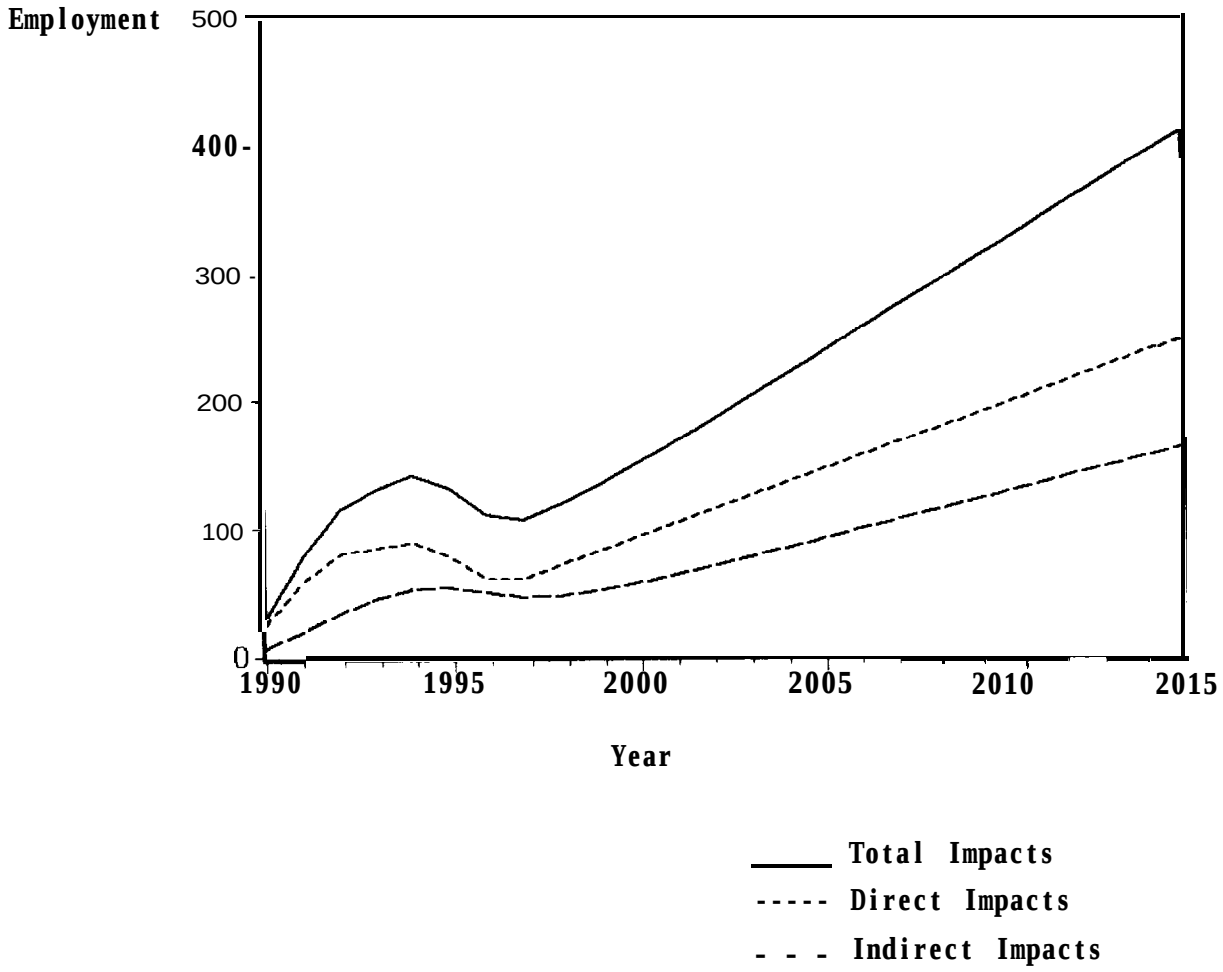
Source: Computed with econometric model.

Figure 7.1. Total Employment Impacts, for 1990-2015.



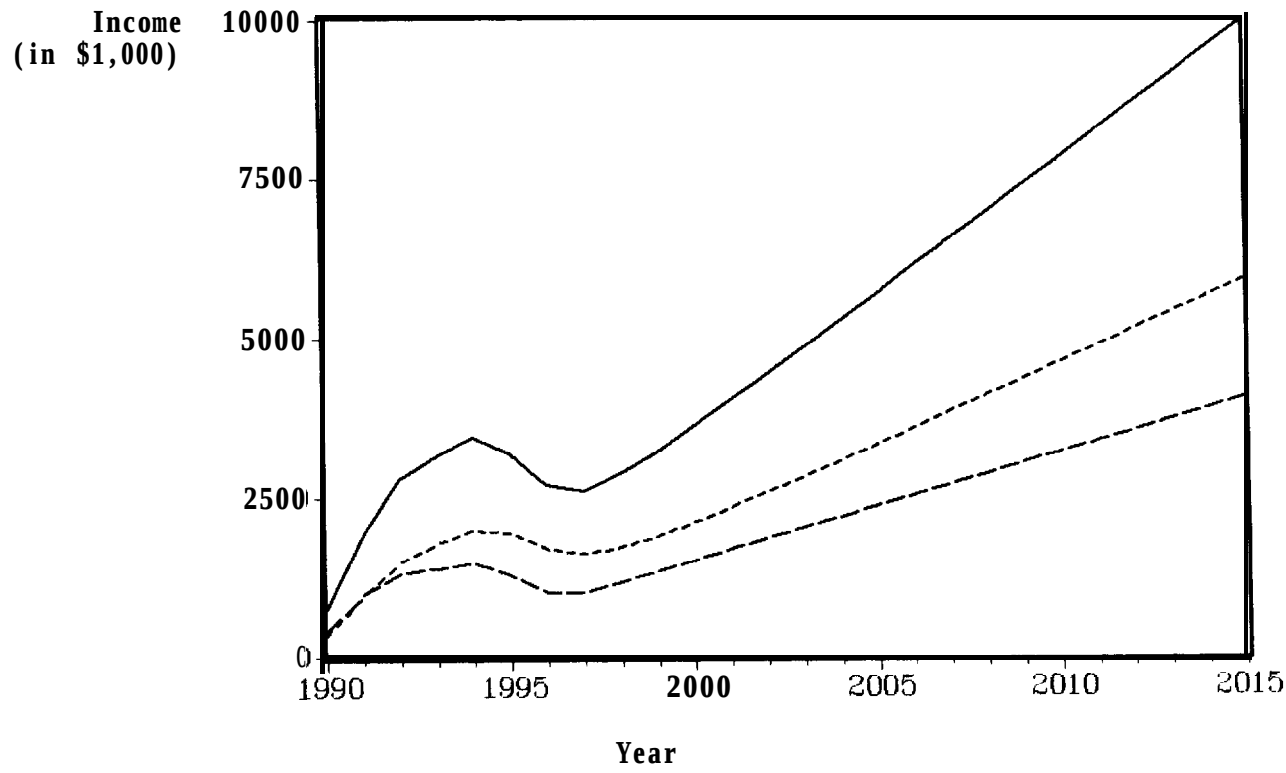
Source: Computed with econometric model.

Figure 7.2. Covered Employment Impacts, for 1990-2015.



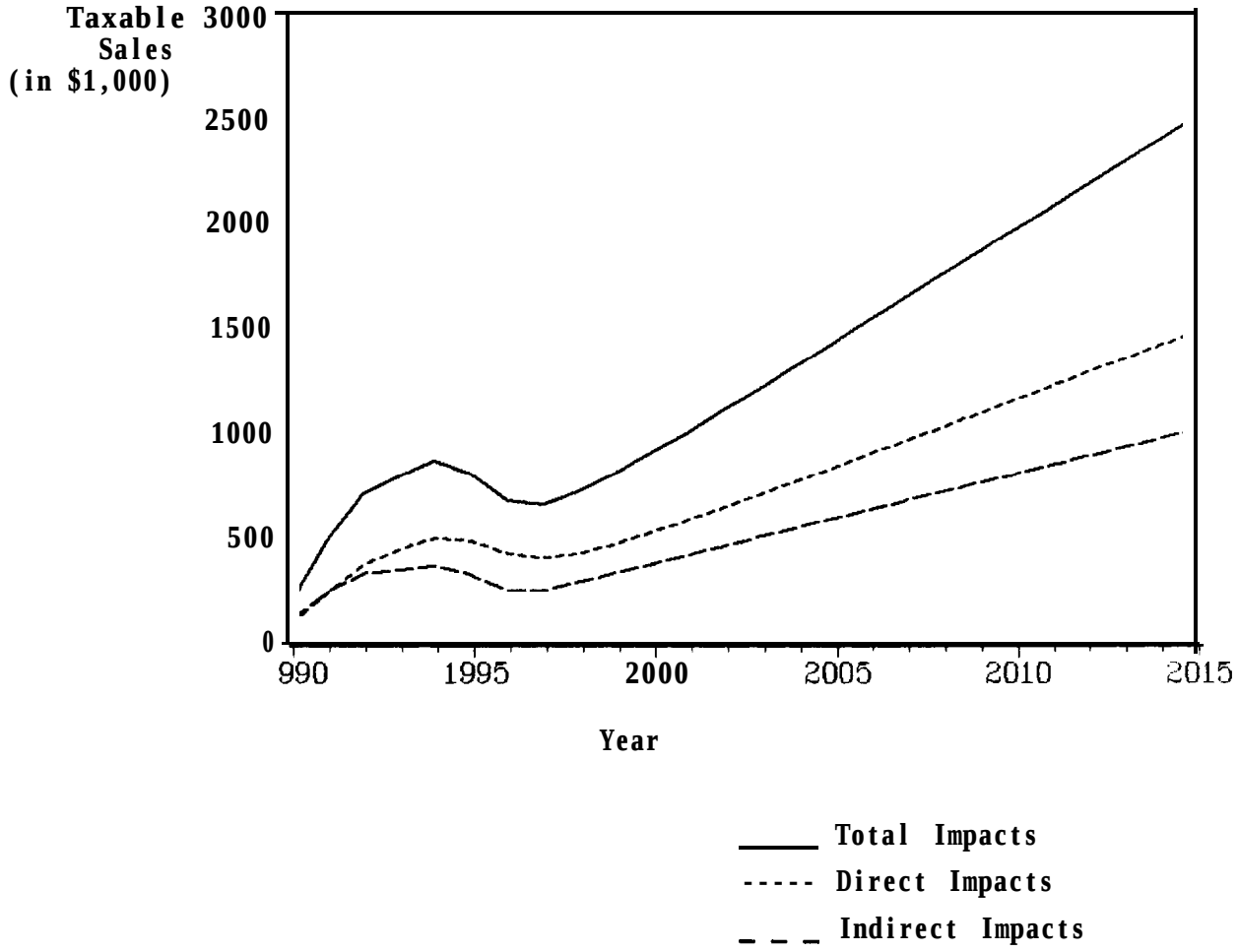
Source: Computed with econometric model.

Figure 7.3. Income Impacts, for 1990-2015



Source: Computed with econometric model.

Figure 7.4. Total Taxable Sales Impacts, for 1990-2015.



Source: Computed with econometric model.

As the construction impacts phase out after 1996, the employment multiplier falls in response to earlier decreases in the direct impacts. The employment multiplier then begins to steadily increase starting in 2001, three years after harvest begins. Although not shown, the employment impact multipliers will reach their steady state level of approximately 2.3 for total employment and 1.8 for covered employment in 2019, four years after the direct impacts have reached their steady state level.

The time pattern of the total income and total taxable sales impacts parallels that of the employment impacts. During the construction phase, the direct income and sales impacts reach their maximum in 1994 at approximately $3,438,400 and $866,100, respectively. In the final period of the study, the additional total income is about $10 million and total taxable sales $2.5 million.

KIYAK Impacts

For purposes of confirming the results of the I/O model, we also estimated employment, income, and sales impacts for the aggregation of Kittitas and Yakima counties. The impact multipliers are quite comparable to the impact multipliers for KIYAK that were developed by the input-output approach in Chapter 6. We estimated direct impacts for the KIYAK econometric model by summing the direct impacts received in both counties. We then ran the model for the study period, 1990 through 2015. It is important to note that the model was not reestimated for KIYAK. The economic relationships for the three-county area were used to proxy the structure of Kittitas and Yakima combined. Hence, changes in the impacts are solely the result of the amount and timing of the direct impacts.

An analysis of the multlpliers generated by the econometric and I/O models is the most direct means of comparing the models. The econometric multipliers for KIYAK are presented in Table 7.7. The covered employment multiplier for 1994, the peak construction expenditure year, is 1.6 and is within 7.5% of the 1.48 value obtained with the I/O model. For the maximum harvest year of 2015, the econometric model multiplier is 1.7, and the I/O model multiplier is 1.52: a difference of 10.6%.

In view of the differences in methodology, the multipliers obtained by the two methods are remarkably close. There is a considerable literature that compares the theoretical and actual differences of multiplier analyses performed on the same geographic areas. (See Kuehn, Proctor, and Curtis, 1985; Braschler, 1972; Romanoff, 1974.) Our findings are supported by this literature, which asserts that (1) the I/O and econometric multipliers should be close to the same value and (2) if a differential exists, the econometric multipliers would be expected to be larger. The explanation for the difference is that the I/O multiplier applies to several components of aggregate demand which are treated endogenously in the econometric model. These components are exports, capital Investment, inventory changes, and government. Therefore, the econometric model, which approximates a dynamic version of a base model, should have slightly higher multipliers than the I/O model (Kuehn, Proctor, and Curtis 1985).

Table 7.7 Impact Multitpliers for Total Employment, Covered Employment, Income and Taxable Sales, for KIYAK Model, 1990-2015.

Year	Total Employment	Covered Employment	Total Income	Taxable Sales
1990	1.5	1.2	1.9	1.9
1991	1.7	1.3	2.0	2.0
1992	1.8	1.4	2.1	2.1
1993	1.9	1.5	2.3	2.3
1994	2.0	1.6	2.4	2.4
1995	2.1	1.7	2.5	2.5
1996	2.3	1.8	2.7	2.7
1997	2.2	1.8	2.6	2.6
1998	2.1	1.7	2.5	2.5
1999	2.0	1.6	2.4	2.4
2000	2.0	1.6	2.4	2.4
2001	2.0	1.6	2.4	2.4
2002	2.0	1.6	2.4	2.4
2003	2.0	1.6	2.4	2.4
2004	2.0	1.6	2.4	2.4
2005	2:o	1.6	2.4	2.4
2006	2.0	1.6	2.4	2.4
2007	2.0	1.6	2.4	2.4
2008	2:o	1.6	2.4	2.4
2009	2.0	1.6	2.4	2.4
2010	2.0	1.6	2.4	2.4
2011	2:o	1.6	2.4	2.4
2012	2.0	1.6	2.4	2.4
2013	2.1	1.7	2.5	2.5
2014	2.1	1.7	2.5	2.5
2015	2.1	1.7	2.5	2.5

Source: Computed with econometric model.

Overall, we feel that the results obtained by the econometric model warranted the efforts and expense of application. We obtained estimates of change in income, taxable sales, and total employment that expand our portrayal of projected changes in the region. The time dynamic has also been expressed, which also contributes to our knowledge about the expected activities in the region. Finally, the separate KIYAK run validates the I/O results for the peak construction and harvest years.

Chapter 8

Summary and Conclusions

After a summary of the objectives and procedures of this study, this chapter presents I/O model and econometric model results and discusses policy implications.

Summary of Objectives and Procedures

The objective of this study was to estimate the economic impact of a two-subbasin fishery enhancement project on local economies. The study covered the time period from construction through maximum sustained yield production. We accomplished this objective by first deriving the direct impacts and then using an input/output model and an econometric model to estimate indirect and induced impacts.

To determine direct impacts, we gathered data relating to four categories of fishery enhancement activities: construction, operations and maintenance, experimentation and monitoring, and harvest. We developed different estimation procedures for the direct impacts stemming from each of these activities. Construction expenditures were allocated into specific industrial sectors and assigned to specific counties and years. To calculate the direct expenditures resulting from operations and maintenance as well as from experimentation and monitoring activities, we allocated broad measures of aggregated project spending into industrial sectors and specific counties. Direct expenditures resulting from harvest activities included both sport fishing and Native American fishing components. In the sport fishing component we accounted for variables such as fishing techniques, catch rates, species, travel distances, and time and location differences. And in the Native American fishing component we accounted for differences related to techniques, location, and species. We also conducted sensitivity analyses to validate assumptions about catch rate and boat/bank split.

We used two complementary methodologies (an input-output model and an econometric model) to estimate indirect and induced Impacts. The I/O model was the U.S. Forest Service's IMPLAN model, modified to use local data. Six runs with this model developed impacts for two time periods (CONSTRUCTION and HARVEST) for each of three economic areas: (1) REGION, the total project area, which encompasses the Yakima Subbasin economy (Yakima and Kittitas counties), the mid-Columbia Klickitat Subbasin economy (Klickitat, Hood River, and Wasco counties), and the Tri-Cities economy (Benton and Franklin counties); (2) KIYAK, which includes only the Yakima Subbasin economy; and (3) RIVER, which Includes only the mid-Columbia/ Klickitat Subbasin economy. In this concluding chapter we emphasize the results obtained for REGION. There is only brief reference to KIYAK and RIVER; complete findings for these two areas are presented in Chapter 6. As explained in Chapter 6, results in the form of total impacts are not available at the county level; direct impacts for individual counties are presented in Appendix K. The results of the REGION model runs are summarized below after a brief explanation of the econometric model and its application.

There were two primary purposes for developing an econometric model for this study: (1) to incorporate time-dynamic impacts that complement the more detailed, static results of the I/O model, and (2) to confirm the findings of the I/O model. To accomplish this, we specified two variations of the econometric model. The first was a dynamic economic base model for Yakima, Kittitas, and Klickitat counties, the areas which receive most of the direct impacts. Least-squares regression techniques were used to estimate the model, first without and then with the project impacts. The results of these simulations--changes in income, taxable sales, and employment--are summarized below. We ran a second econometric model to validate the I/O results. With this model, we estimated multipliers for an aggregation of Yakima and Kittitas counties to compare the magnitude of the multipliers to those obtained through the I/O process.

Summary of Results

In this summary, we concentrate upon the results of the REGION models. Table 8.1 summarizes the annual results obtained by running the REGION model under the assumption of prime contracts awarded to an out-of-area firm. In the construction period, the project will generate annually $8,753,135 of additional output, $4,036,856 of additional income, and 129 new jobs. Although the greatest output effects will occur in the construction sector, the greatest income and employment changes accrue to the service sector in the form of $1,397,088 of new income and 46 additional jobs.[l] Because the service sector requires more employment per dollar of output, more new jobs will be generated by the service sector even though the construction sector will experience a greater change of output.

Annual harvest results for the REGION model are also summarized in Table 8.1. The project will produce annual impacts of $17,627,154 in output, $8,507,806 in income, and 409 jobs. In comparing the two periods, we noted that harvest period output is twice that of the construction period, and harvest period employment is three times that of the construction period. Differences in industry mix in the two periods explain the apparent discrepancy in magnitude of output and employment impacts. That is, as compared to the construction period expenditures, harvest period expenditures have relatively more impact on the service sector and on other labor intensive sectors. From the construction period to maximum sustainable yield harvest, the trend of all three variables--output, income, and employment--is clearly upward. Accordingly, we find no implications of a construction boom and bust cycle, which is often associated with construction projects.

Econometric Model Results

Table 8.2 summarizes results obtained in the econometric model. The table presents annual values of changes in total employment, covered employment,

Table 8.1 Annual Impacts for Construction Period and Harvest Period, REGION Model. <a> <b>

Construction Period

	OUTPUT	INCOME	EMPLOYMENT
AGRICULTURE, FORESTRY AND FISH	$85,592	$25,371	3
MINING	238,504	124,582	2
CONSTRUCTION	2,403,780	717,295	15
MANUFACTURING	1,367,008	444,231	12
TRANSPORTATION AND UTILITIES	573,753	305,917	8
TRADE	602,616	344,035	32
FIRE	665,767	426,742	17
SERVICES	2,375,274	1,397,088	46
GOVERNMENT	440,842	251,595	8
TOTAL	$8,753,135	$4,036,856	143

Harvest Period

	OUTPUT	INCOME	EMPLOYMENT
AGRICULTURE, FORESTRY AND FISH	$294,895	$84,654	9
MINING	6,940	3,492	0
CONSTRUCTION	1,327,198	373,995	10
MANUFACTURING	1,620,410	446,605	13
TRANSPORTATION AND UTILITIES	1,033,897	542,805	10
TRADE	5,361,487	3,060,823	156
FIRE	725,957	451,630	17
SERVICES	6,455,569	3,123,059	178
GOVERNMENT	800,802	420,742	15
TOTAL	$17,627,154	$8,507,806	409

SOURCE: Computed with IMPLAN REGION model.

<a> In 1989 dollars of output and income and in units of employment.

<b> Assumes outside contractor.

Table 8.2 Summary Table, Econometric Model: Total Impacts and Associated Multipliers for the years 1990-2015. Total Impacts Measured in Units of Total Employment and Covered Employment, 1989 Dollars of Income and Taxable Sales. Multipliers in Parentheses.

Year	Total Employment (multiplier)	Covered Employment (multiplier)	Income (multiplier)	Total Taxable Sales (multiplier)
1990	38 (1.5)	31 (1.2)	$748,840 (1.9)	$188,640 (1.5)
1991	98 (1.7)	79 (1.3)	1,915,160 (2.0)	482.480 (1.6)
1992	142 1.8)	115 (1.4)	2,790,160 (2.1)	702: 620 (1.7)
1993	161 1.9)	130 (1.5)	3,156,400 (2.3)	795,180 (1.8)
1994	176 2.0)	142 (1.6)	3,438,400 (2.4)	866,100 (1.9)
1995	164 2.1)	132 (1.7)	3,196,800 (2.5)	805,240 (2.0)
1996	137 (2.3)	110 (1.8)	2,680,960 (2.7)	675,200 (2.2)
1997	133 (2.2)	107 (1.8)	2,598,640 (2.6)	654,620 (2.1)
1998	147 (2.1)	118 (1.7)	2,872,120 (2.5	723,460 (2.0)
1999	165 (2.0)	133 (1.6)	3,216,800 (2.4 I	810,400 (1.9)
2000	184 (2.0)	148 (1.6)	3,597,160 (2.4)	906,120 (1.9)
2001	204 (2.0)	165 (1.6)	3,996,640 (2.4)	1,006,740 (1.9)
2002	225 (2.0)	182 (1.6)	4,407,000 (2.4)	1,110,000 (1.9)
2003	247 (2.0)	199 (1.6)	4,823,960 (2.4)	1,214,820 (1.9)
2004	268 (2.0)	216 (1.6)	5,244,640 (2.4)	1,321,160 (1.9)
2005	290 (2.0)	233 (1.6)	5,667,120 (2.4)	1,427,540 (1.9)
2006	312 (2.0)	251 (1.6)	6,091,360 (2.4)	1,534,240 (1.9)
2007	333 (2.0)	268 (1.6)	6,516,480 (2.4)	1,641,500 (1.9)
2008	355 (2.0)	286 (1.6)	6,941,960 (2.4)	1,748,520 (1.9)
2009	377 (2.0)	304 (1.6)	7,367,640 (2.4)	1,855,860 (1.9)
2010	399 (2.0)	321 (1.6)	7,793,520 (2.4)	1,963,240 (2.0)
2011	420 (2.0)	339 (1.6)	8,220,000 (2.4)	2,070,400 (2.0)
2012	442 (2.0)	356 (1.6)	8,646,160 (2.4)	2,177,900 (2.0)
2013	464 (2.1)	374 (1.7)	9,072,280 (2.5)	2,285,160 (2.0)
2014	486 (2.1)	391 (1.7)	9,498,880 (2.5)	2,392,620 (2.0)
2015	508 (2.1)	409 (1.7)	9,925,200 (2.5)	2,500,000 (2.0)
Total	**6,875**	5,537	$134,424,280	$33,859,760

Source: Computed with econometric model.

income, total taxable sales, and each respective impact multiplier. Table 8.2 shows

- an overall increase in total economic activity brought about by the fishery enhancement project,
- a construction period impact peak that occurs in 1994,
- a harvest impact peak that occurs in 2015,
- a slight dip in regional economic activity that commences In 1995 and ends with the third year of harvesting in 2000,
- a level of economic activity (measured by covered employment and real Income) that is 2.8 times as great in the peak harvest year than in the peak construction year,
- a peak in the multiplier effects occurring two years after the peak in total impacts because of the lag effect of business capacities matching demand levels,
- a $134,424,280 increase in income for the 25-year period,
- a $33,859,760 increase in taxablesales for the 25-year period, and
- a 6,875 person-year increase in total employment for the 25-year perIod.[2]

Other Findings

Several qualitative findings of this study include implications of a gradual transition from construction to harvest, a positive contribution to regional structural change, an important role for the service sector in project impacts, and a mixture of quality in new jobs.

As for the dynamics of transition from construction to harvest, there will be no construction-related boom and bust, but a relatively steady building of jobs and income. There are three reasons for this: (1) the existence of continued operations and maintenance expenditures and experimentation and monitoring expenditures partially ameliorate the dropping off of construction expenditures in 1995, (2) the addition of Phase II screening and enhancement (passageway) construction helps to smooth the transition into and out of the three years of major hatchery construction, and (3) the nature of expenditures associated with experimentation and monitoring as well as operation and maintenance activities during the construction period shift some of the impact away from the purely construction-related sectors and into the service sector. These increases in service sector activities somewhat smooth the transition into the strong service sector impacts of the harvest period.

The service sector impacts during the harvest period have a second effect upon the region. The study region, and eastern Washington in general, have neither shared the prosperity or the positive structural transition that the metropolitan counties of western Washington experienced from 1984-1989. While western Washington's economy has shifted from extraction and primary activities and to high technology industries and advanced business and professional services, the study region employment in primary industries and agriculture has eroded, and there has not been sufficient compensatory development in the service sector. This project will generate more service sector activities, and thus aid the process of long-term transition.

The shift into tourist related activities will represent a new undertaking for much of the region. The gradual changes in sport fishing will induce increases in tourism. In many locations, enterprises will open in sectors that had no competitive activities within twenty to fifty miles. These enterprises will be engaged in marinas, tackle sales, guide services, and traditional hospitality industries.

The long run impacts create jobs in the services and in the retail industries, particularly in the hospitality and recreational-related retail industries. There is a considerable literature that debates the question of the quality of service sector employment. (see Loveman and Tilly, 1988). Some of the employment generated by this project will have high incomes. Government employment in facility operation and maintenance falls into that classification; on-site personnel employed in the experimentation and monitoring activities will likewise bring high quality jobs to some of the smaller places in the region. However, a large portion of new employment will be in retail, recreational services, and hospitality industries. These tend to be low paying and often part-time jobs. Weighing together the high and low quality new jobs, we find the jobs generated by the project will likely not reach the national average of quality for new service sector jobs. Yet, there are two bright spots in this scenario: (1) these are jobs in a region that has had a decade of high unemployment levels and out-migration of youth; and (2) because of the nature of the expanded industries, better than average opportunities for local proprietary activity will be forthcoming. Although some of the stimulated economic sectors may result in national franchises moving into the area, as a whole, activities will support local business entry.

A final aspect of quality of project impacts involves the way In which construction bids are packaged. There is a quantitative difference of up to 37% more construction period income that depends upon the extent to which in-region contractors are successful bidders. Local contractor activity will also maintain or improve regional employment and skills for the heavy construction industry and for its subcontractors. On the other hand, some forms of bidding package will make an outside contractor more likely and will lower both quality and quantity of job requirements.

In summary, we find long run quantitative and qualitative impacts resulting from the fishery enhancement project. During the harvest period the project will bring annually $17,627,154 in output and $8,507,806 in income and 409 new jobs to the region. On the qualitative side, the project will bring continuing economic change which will aid in the structural evolution of the region's economy.

Notes

[1] We tested the sensitivity of the construction model by generating a second run that assumed that all the prime contractor awards were granted to in-region firms. Under this assumption, annual output will be 44% higher, annual income 39% higher, and job generation 32% greater. In reality contracts will be awarded to both local and out of area firms. It is clear that total impacts are very sensitive to that allocation.

[2] A second version of the econometric model, run on a two-county area, Yakima and Kittitas, serves to check the I/O model. The resulting covered employment multipliers for the peak construction year are 1.49 from the I/O model and 1.60 from the econometric model. For the peak harvest year, the multipliers are 1.52 from the I/O model and 1.70 from the econometric model. As noted in Chapter 7, the multipliers for the peak construction year are within 7.5% of each other and for the maximum sustained yield harvest year they are within 10%. In view of the differences in methodology, the multipliers are remarkably close; furthermore, the econometric multiplier is the larger in both cases, which is consistent with current literature on regional multipliers. Overall, the findings of this econometric run confirm those of the I/O models.

APPENDIX A

BRIEF DESCRIPTIONS OF COUNTIES INCLUDED IN STUDY

Kittitas County

Kittitas County is located east of the Cascade mountalns in the geographical center of the state. It has an area of 2,320 square miles and ranks seventh in the state of Washington. The western border of the county lies at Snoqualmie Pass in a somewhat alpine forested environment, and the eastern border lies in the arid shrub-steppe environment of eastern Washington. The western and northwestern portions of the county are forested, some National Forest and some privately-owned forest lands. The valley plans and terraces, known as the Kittitas Valley, extend northwest by southeast through the center of the state. Elevation ranges in the county from about 1,500 to 4,100 feet above sea level. The climate is characterized by a median yearly temperature of 46.1 degrees Fahrenheit, a growing season of 140 days, and the majority of the yearly precipitation falling during the winter months. The estimated total population for the county in 1987 was just over 25,000, 10.8 persons per square mile. The principle economic activities in Kittitas County are education (Central Washington University), food processing (Twin City Foods), agriculture (grains, fruit production, and ranching, principally), and manufacturing. The 1987 sectorial sources of total income (in percentage of total) were: agriculture, 9.7%; construction, 3.6%; manufacturing, 10.2%; transportation, 6.8%; retail, 12.54%; FIRE and services, 13.07%; government, 38.2%; other 5.8%. The inclusion of Central Washington University accounts for the high percentage of government activity. Per capita income is $10,490; the county rank is 32 out of 39 Washington counties.

Klickitat County

Klickitat County is located in south central Washington on the Columbia River. It has an area of 1,908 square miles. Klickitat County is bordered to the north by Yakima County and to the east by Benton County. Its southern border is the Columbia River, and Skamania County is its western border. The general topography of Klickitat County is one of mountains, plateaus, and narrow valley lowlands. Elevation ranges in the county from 50 to 5,800 feet above sea level. The climate is characterized by a median yearly temperature of 48.4 degrees Fahrenheit, a growing season for 110 to 130 days, and the majority of the yearly precipitation falling In the winter with a county range of precipitation of 6 to 60 inches total yearly. The estimated 1987 county population is about 16,500, with a density of 8.6 persons per square mile. The principle economic activities in Klickltat County are: wood products (Bingen Plywood Co., SDS Lumber Co., Log Processing Inc.), metal industries (Columbia Aluminum), and agriculture. The 1987 sectorial sources of income (as a percentage of total) were: agriculture, 9.6%; construction, 2.7%; manufacturing, 50.6%: transportation, 4.2%; retail, 4.6%; FIRE and services, 6.8%; government, 17.9%; other, 3.22%. Per capita income was $10,983; the county rank is 28 out of 39 state counties.

Yakima County

Yakima County is located in south central Washington State. The total area of Yakima is 4,273 square miles; it ranks second in the state in size. Yakima County is bordered to the north by Kittitas County and to the south by Klickitat County, Benton County to the east, and Thurston County to the west. The geography of the county is diverse. Yakima County varies from areas of rough, irregular, densely timbered mountainous terrain in the western regions to rolling foothills, broad valleys, and arid sagebrush-covered regions in the east. Elevation ranges in the county from 400 feet along the Columbia River to 12,307 feet at the summit of Mt. Adams. The climate of Yakima County is characterized by a median yearly temperature of 52.1 degrees Fahrenheit, a growing season of 140 to 180 days (county range), and the majority of the total yearly precipitation falling during the winter months. The estimated total population (1987) is about 184,000, 43.2 persons per square mile. The principle economic activities in Yakima County are agriculture, food processing, wood products, and manufacturing. Yakima County is one of the nation's richest agricultural counties and leads the state in apple, pear, peach, and grape production, while other agricultural specialties such as hops and mint also play a major role. Wood products and food processing are key components of the county's economy. Major companies in the industrial sector include Stadelman Fruit, Boise Cascade Corp., Del Monte Corp., and Washington Beef. The 1987 sources by sector of income (as a percentage of total) were: agriculture, 16%; construction, 4.5%; manufacturing, 14.7%; transportation and public utilities, 5.9%; retail, 20.6%; FIRE, 3.0%; services, 19.1%; government, 16.32%. Per capita income was $10,380; the county ranking is 33 out of 39 state counties.

Benton County

Benton County is located in south-central Washington in the middle of the Columbia Basin. It has an area of 1,722 square miles, ranking 22nd in the State of Washington. The Columbia River forms Benton County's northern, eastern, and southern boundary. Yakima and Klickitat counties border to the west. The geography of the area is essentially described as basin and valley bottomland with upland plateau, and the area is crossed by long mountain ridges. The area is fairly uniform with slopes of 3% or less and elevation ranges from approximately 300 to 1,000 feet. The climate of Benton County is characterized by a median yearly temperature of 50.9 degrees Fahrenheit, a growing season of 150-180 days (county range), and the majority of the precipitation falls during the fall and winter months. The estimated total population (1987) is about 104,100. Population density is 60.4 persons per square mile. The principle economic activities in Benton County are food processing, chemicals, metal products, and nuclear products. The establishment of the Hanford Atomic Energy Center has made the county one of the nation's major atomic research centers. Overall, the county enjoys a diversified economy based on agriculture, wood products, food production, and government installations. Major companies in the industrial sector include Rockwell Hanford, Battelle Northwest, U.N.C., Westinghouse Hanford, and Twin City Foods. Sources of employment for the major private and non-agricultural sectors (1986) were manufacturing, 33%; construction, 17%; transportation/utilities, 2%; wholesale/retail trade,

21%; finance/insurance/real estate, 3%; personal/business services, 34%; and miscellaneous, 6%.

Franklin County

Franklin County is located in south-central Washington State. The total area of Franklin County is 1,259 square miles: it ranks 27th in the state in size. Franklin County is bordered by Adams County to the north and Whitman County to the east. The Columbia River forms Franklin's western boarder and the Snake River forms its southern border. The geography of the county is characterized by higher country in the north crossed by a few fairly deep glacial drainage channels. This area slopes downward to an extensive, fairly level basin in the southern part of the county. Irrigated agriculture, mostly in the western part of the county, comprises 41% of the county land, while dryland farming in the central and eastern part of the county comprises 31%. Elevation ranges from 340 feet at Pasco (the county seat) to over 1,000 feet in the northeastern part of the county. The climate of the county is characterized by a median yearly temperature of 54.6 degrees Fahrenheit, a growing season of 135-160 days (county range), and the majority of the precipitation falls in the fall and winter months. The estimated total population (1987) is 35,500. Population density is 28.2 persons per square mile. The principle economic activities are food processing, publishing, agriculture, and metal fabrication. Franklin County bases its economy on agriculture with wheat, barley, and beans as principle crops. Pasco is a major part of the Tri-Cities market area. Major companies in the industrial sector include Tater Boy, Lamb-Weston, Burlington Northern, and Fresh Pak Sales. Sources of employment for each of the major private and non-agricultural sectors (1986) were manufacturing, 20%; construction, 5%; transportation/utilities, 7%; wholesale/retail trade, 38%; finance/insurance/real estate, 3%; personal/business services, 21%; and miscellaneous, 6%.

Wasco County

Wasco County is located across the Columbia River (south) from Klickitat County, Washington, in north central Oregon. Wasco County has a total area of 2,396 square miles, a middle-sized county for Oregon. Wasco County embraces the eastern Cascades to the west, and the Columbia River to the north. The climate of Wasco County is quite moderate, with an average January temperature of 33.4 degrees Fahrenheit and a July average of 73.1 degrees Fahrenheit. Wasco's annual precipitation is approximately 13.17 inches. The county seat, The Dalles, is a major hub for north central Oregon's agricultural economy. The principle economic activities in the county are agriculture (cereal grains, sweet cherries, livestock), lumber, manufacturing, electric power, and transportation. Wasco County's agricultural economy is typified by orchards and inland wheat and livestock ranches. Total population for Wasco County (1987) was approximately 22,500. Sources of employment for each of the major private and non-agricultural sectors (1986) were manufacturing, 13%; construction, less than 1%; transportation/utilities, 4%; wholesale/retail trade, 39%; finance/insurance/real estate, 5%, personal/business services, 34%; and miscellaneous, 5%.

Hood River County

Hood River County is located to the west of Wasco County and is a relatively small county for Oregon. The total area of the county is 533 square miles, with a total population (1987) of 16,400. Average yearly temperatures during January are 33.6 degrees Fahrenheit, and 66.7 for July. Average annual precipitation is 30.85 inches. Agriculture, food processing, timber, lumber, and recreation are the principle economic activities in Hood River County. Fruit grown in the fertile valley is of such exceptional quality that the county leads the world in D'anjou pear production. More than 14,000 acres of commercial pear, apple, cherry, and peach orchards contribute to the bounteous image of Hood River. The county also attracts wind-surfers from all over the world who come to wind surf the Columbia River at Hood River. Sources of employment for each of the major private and non-agricultural sectors 91986) were manufacturing, 21%; construction, 3%; transportation/utilities, 12%; wholesale/retail trade, 31%; finance/insurance/real estate, 2%; personal/business services, 29%; and miscellaneous, 2%.

APPENDIX B

EXISTING FISHERIES OF THE YAKIMA AND KLICKITAT SUBBASINS

The Yakima River Subbasin

At one time the Yakima Subbasin supported large numbers of anadromous fish and was one of the largest fishery resource contributors to the Columbia River Basin. Historically, runs of anadromous salmonids, most notably spring chinook and sockeye, were key production elements to the total Columbia River fishery. Total production of anadromous fish in the Yakima River has been estimated at 620,000 fish (Draft E.A., p. 32). In addition to spring chinook and sockeye, the Yakima also supports anadromous fish runs of fall chinook and summer steelhead. Resident rainbow trout, brown trout, and cutthroat trout are important non-anadromous fish that play a role in the region's economy. The species of principle importance will be described.

Spring chinook historically represented the largest portions of the anadromous fish runs in the Yakima River Subbasin, with estimates of the run having been at about 200,000 (E.A., p. 32). Spring chinook are a prized sport fish, as well as important for commercial and subsistence harvests.

Spring chinook return to the Yakima River from April to August, with spawning occurring in August and September. The fry emerge from the spawning gravels in late March through mid June, depending on the spawning date and the water temperatures. Rearing is generally a year, with smolt outmigrating from April through June. Some fish may reside and rear for a second year and outmigrate the following spring.

Hatchery enhancement effects with spring chinook in the Yakima River Subbasin have been relatively modest compared with other major rivers in the Columbia River Basin (Draft E.A., p. 32). In the past five years the number of fry and smolt released has ranged from 72,000 to 364,000, with the primary source of broodstock coming from the Carson/Leavenworth stock, but also including fish from the Ringold and the Klickitat and Cowlitz rivers. Incidences of interbreeding between wild and hatchery fish are lessened because of the low return rates in the past coupled with the non-synchronous spawning time of the Leavenworth and Klickitat fish (mid August) with the Yakima stocks (mid to late September).

The spawning areas for spring chinook in the Yakima River extend upstream of Cherry Creek (near Ellensburg) on the mainstem, with most occurring above the Teanaway River, and on the Naches River upstream from the confluence with the Tieton River. Fry rear in the mainstem rivers and to a lesser degree in the tributaries adjacent to or below spawning areas. These tributaries include Big, Little, Swauk, Manastash, Taneum, and Umptanum creeks. Ahtanum, Satus, and Toppenish creeks and the Teanaway River are not presently used by spring chinook (Draft E.A., p. 37). Smolt capacity for spring chinook in the Yakima Subbasin has been estimated at somewhere between 1,500,000 and 3,000,000, depending on the source (Draft E.A., p. 37.)

Summer chinook are absent from the Yakima system. The same factors that led to declines in the spring chinook runs, such as overfishing, timber

practices, dams, and irrigation diversion structures have led to similar impacts on summer chinook runs. In addition, summer chinook populations were severely affected by low water flows and high temperatures in the lower river. As a result, the run of summer chinook was hit hard by water diversions which led to their extinction. The potential for the run has been estimated at about 15,000.

Natural runs of coho salmon are absent from the Yakima River system. The same factors affecting chinook stocks led to the demise of the coho stock, due in some part to the poor fish passage design at the old Roza Dam. Most of the production areas for coho are above Roza Dam and include the mainstem above the Teanaway, Taneum, and Umptanum creeks. No estimates of the historical size of the Yakima coho run exist. Sporadic hatchery outplantings have produced very low returns, with survival rates averaging only 0.09% (Draft E.A., p. 38).

Fall chinook were once fairly abundant in the Yakima system. Estimates of the historical run size place the combined run of summer and fall chinook at 202,500, with present carrying capacity from about 40,000 to 80,000 adults or about 3.5 to 6.5 million smolts. Known spawning areas and rearing areas extend from the Sunnyside Dam to the Columbia River confluence. It has been estimated that 70% of the spawning activity occurs below Prosser and 30% above Prosser. Fall chinook were most likely affected more by water quality problems than passage problems due to the warm turbid irrigation drain water that comprises most of the river water during low water years, affecting fall chinook the most.

Migration of fall chinook in the Yakima begins in mid September and extends through mid to late November. Spawning occurs in October and November, and incubation extends from October through March with emergency occurring in February and March. Yakima fall chinook rear from 90-120 days and outmigration begins in late April, peaks in late May, and extends through early July. Hatchery release of fall chinook have averaged about 1.1 million for the last five years.

Sockeye salmon were once abundant in the Yakima River system. Sockeye juveniles were using Bumping, Cle Elum, Kachess, and Keechelus lakes for fresh water rearing. Spawning areas were probably above these lakes. Because the lakes were raised and dams installed in the early 1900s, without fish passage facilities, the populations were effectively destroyed. The historical size has been estimated at about 32,000. Presently there are kokanee (landlocked sockeye) present in a number of the lakes in the Yakima Subbasin.

Summer steelhead exist in reduced numbers in the Yakima system, and the same factors effecting the salmon populations have affected the steelhead runs. Steelhead are particularly vulnerable to habitat degradation and loss and passage problems in the smaller tributaries. The completion of Roza dam in 1940 was of particular importance, because about one-third of the potential habitat lies above this point, and passage was not effectively available for steelhead at Roza.

Steelhead were once found in nearly every reach and tributary of the Yakima system. Primary production areas now lie below the confluence in and

around Satus and Toppenish creeks. Eighty to 90% of the steelhead production in the Yakima now occurs below Sunnyside Dam. Carrying capacity is estimated at between 375,000 and 1.1 million.

Resident trout are currently abundant from Easton to Roza at the lower end of the gorge. Due to the absence of salmon and steelhead above Roza, the resident trout population has probably expanded well above its historical population levels. The upper Yakima has thus become a very popular recreatlonal fishing spot, especially for fly fishers.

The Klickitat River Subbasin

The Klickitat River has historically been an Important fishery resource within the Columbia Basin. A significant Indian fishery existed at Lyle Falls prior to 1920. Presently, a dip net fishery exists at Lyle Falls and Falls #5 No historical evidence of the abundance of anadromous fish exists. Spring chinook followed by summer and winter steelhead represent the principle anadromous fish species currently in the Klickitat. Resident rainbow trout exist in good numbers, but numerical abundance is undocumented.

Spring chinook are present in the Klickitat system in moderate numbers. In the last decade the run sizes have ranged from 1,614 to 3,488 fish with a mean of 2,533 fish (Draft E.A., p. 75). Historical abundance was probably much higher based on available habitat. Carrying capacity has been estimated at 338,871 to 682,000 smolts per year depending on the calculation used. Spring chinook runs on the Klickitat have declined due to the same reasons discussed for the Yakima River runs. Overfishing and construction of Bonneville Dam are the primary causes. Many fish passage facilities have been made in the Klickitat Subbasin and have increased the amount of habitat available.

Adult spawning migration of spring chinook in the Klickitat River begins in April and continues through July. Spawning occurs from August through October. Natural production in the Klickitat River is currently very low based on redd counts. Natural escapement has ranged from 7 to 20 during the past ten years. Fishery managers believe that most natural spawning fish are hatchery strays at the present time. Hatchery production in the Klickltat is substantial at present. The WDF Klickitat hatchery produces 600,000 smolts per year, at 10 smolts per pound.

Summer steelhead are present in relatively abundant numbers in the Klickitat Subbasin. Escapement in the last 10 years has averaged 6,290 fish, of which 61% were caught by tribal and recreational fishers. Natural production is currently estimated at 49,000. The estimated carrying capacity is somewhere between 121,000 and 302,000 smolts. Using either extreme, It is clear that production is well below normal potential.

The reasons for steelhead decline in the Kllckitat River are the same as for chinook, with the addition of additional habitat degradation in the smaller (third and fourth order) streams and tributaries. These additional alterations in the major spawning areas include water diversions for

agriculture, siltation, debris blockage, removal of riparian vegetation, and cattle grazing.

Summer steelhead migrate in the Klickitat River starting in April and continuing to December. Spawning probably starts in January, extending through April of the following year. Juvenile life history has revealed that 94% of the steelhead rear for two years prior to outmigrating as smolts.

Winter steelhead are presumed to exist, but no direct counts have been made. Life history of winter steelhead in the Klickitat are not well known. The adult spawning migration is thought to begin In January and extend through May, with spawning occurring March through June.

Fall chinook are moderately abundant in the Klickitat River as a result of enhancement efforts. The present average return to the subbasin Is estimated to be about 1,452 fish.

APPENDIX C

YAKIMA AND KLICKITAT SUBBASINS ENHANCEMENT ACTIVITIES AND ASSOCIATED COSTS

INTRODUCTION

This appendix details the requirements and costs of enhancement strategies that are required by the hatchery. The estimates were developed by the subbasin planners, Bruce Watson, consultant for the Yakima Subbasin, and David Lind, consultant for the Klickitat Subbasin. In applying these estimates to the construction and operations and maintenance modules, the lower cost estimate was chosen whenever alternative means of enhancement were detailed.

YAKIMA SUBBASIN

by Bruce Watson

Additional Habitat

Because spring chinook are fall spawners that will utilize intermediate-sized tributaries, they encounter relatively more problems in the Yakima Subbasin than any other species. Peak spawning occurs in the month of September, when instream flows are near the natural low point and irrigation demand is near its peak. In many tributaries, the combination of these factors currently results in flows that are too low for passage of spawning adults. These same tributaries do, however, almost always carry enough water in the spring, when steelhead spawn, to permit easy passage of adults. Thus, in the Yakima Subbasin, it is fairly common to encounter a tributary whose unrealized steelhead potential may be practicably developed, but whose spring chinook potential would require herculean efforts to develop.

The major area of uncertainty in the Yakima Subbasin Plan is the designation of tributaries to be targeted for development of their unrealized spring chinook potential. In turn, this issue reduces basically to the cost-effectiveness of providing minimal flows for adult passage. Although the provision of fishways ("fish ladders") at impassable barriers (usually diversion dams), and the installation of screen/bypass systems at irrigation ditches are also problems demanding resolution, the cost and political difficulty of resolving the latter problems are qualitatively less than the cost and political difficulty of resolving the instream flow problem.

The major tributaries with unrealized spring chinook and steelhead potential include Cabin Creek, the Teanaway River system, Taneum Creek, Manastash Creek, Ahtanum Creek and Logy Creek (Logy already produces a substantial number of steelhead). There are other tributaries or reaches of mainstream with unrealized potential for both of these species, such as the Yakima River between Keechelus and Easton Dams, but these latter areas do not require resolution of problems of the same degree of difficulty as the former. This analysis will address only the "problematic set" of tributaries; see the Subbasin Plan for the full list of tributaries comprising "additional habitat." Note also that Cowiche Creek is a "semi-controversial" tributary with potential for steelhead only, and

Wanity Slough (a portion of the Wapato Irrigation Project) is a similarly controversial "tributary" with fall chinook potential.

At the present time, neither Subbasin Planning nor YKPP planning is complete. It is thus a risky business to speculate which controversial tributaries will be developed for which species. However, the impact analysis requires this risk be run. Accordingly, I have designated which tributaries in the controversial list will be developed, and the species for which they will be developed. In subsequent pages, I present associated cost and production estimates.

Assuming that tributaries are developed as described in Table C.l, and that the other special elements of the Subbasin Plan (halving smolt loss, rebuilding Phase-II screens and providing winter refuges) are implemented, the species-specific production is displayed in Table C.2 below.

A very speculative estimate of the cost of bringing the additional habitat identified in Table 1 into production is $3.668.884. (See "Habitat Costs" appendix for derivation and qualifications.) Note that these costs include 0 & M costs projected over 50 years. Note also that the very difficult problem of providing additlonal flows for adult salmon passage on the Teanaway was not solved: a $26,500/year "trap and haul" cost was simply projected over 50 years. (This figure undoubtedly must be revised upward to reflect inflation.)

Table C.l. Probable Development Pattern of Controversial Production Areas.

Production Area	Developed for Spring Chinook[a]	Developed for Steelhead[b]	Developed for Fall Chinook
1. Cabin Cr.	No	Yes[c]	No
2. Teanaway R.	Yes	Yes[c]	No
3. Taneum Cr.	Yes	Yes[c]	No
4. Manastash Cr.	No	Yes[c]	No
5. Ahtanum Cr.	Yes	Yes	No
6. Cowiche Cr.	No	Yes	No
7. Logy Cr.	Yes	already developed	No
8. Toppenish/Simcoe	No	Yes	No
9. Wanity Slough	No	No	No[d]

[a]"Non-controversial" spring chinook areas, with negligible associated costs, include: the Yakima between Easton and Keechelus Dams; and the Little Naches above Salmon Falls.

[b]"Non-controversial" steelhead areas include: non-controversial spring areas; and Wide Hollow Creek.

'Assumes it is ultimately decided to plant YKPP steelhead above Roza Dam.

[d]Development of Wanity Slough and an intersecting canal (Drain 4) for fall chinook was proposed in the Yakima Subbasin Plan. Subsequently, additional difficulties, especially problems with water quality, have been discovered. Thus, at least for the purposes of cost-benefit analysis, this area is withdrawn.

Table C.2. Yakima Subbasin Production Plans[a]

Species	Escapement to Subbasin	Sustainable Terminal Harvest	Terminal Harvest Rate	Total Harvest to All Fisheries	Natural Spawning Escapement
Spring Chinook					
Existing[b]	4,910	1,424	.29	2,539	2,789
Enhanced[b]	21,498	12,467	.58	17,250	7,225
Net Increase	16,588	11,043	(.29)	14,711	4,436
Summer Steelhead[c]					
Existing[d]	4,107	780	.19	1,605	2,994
Enhanced[d]	22,961	11,251	.49	15,863	10,539
Net Increase	18,854	10,471	(.30)	14,258	7,545
Fall Chinook					
Existing[e]	3,304	628	.19	13,827	2,409
Enhanced[e]	7,839	4,390	.56	35,723	3,106
Net Increase[e]	4,535	3,762	(.37)	21,896	697
Summer Chinook[f]					
Existing[g]	0	0	0	0	0
Enhanced[h]	7,977	4,866	.61	7,781	2,489
Net Increase	7,977	4,866	(.61)	7,781	2,489
Coho[f]					
Existing[g]	0	0	0	0	0
Enhanced	6,151	3,260	.53	17,431	6
Net Increase	6,151	3,260	(.53)	17,431	6

[a] Based on "Yakima Subbasin Plan" and "Refined Statement of Goals Yakima/Klickitat Production Project."

[b] "Enhancement" of spring chinook includes the following strategies (modified slightly from "Yakima River Subbasin, Salmon and Steelhead Plan," June 20, 1989, Draft): Strategy 1: implementation of YKPP with existing habitat; Strategy 2: Strategy 1 plus additional habitats described in Table 1; Strategy 3: Strategy 2 plus halving open-river smolt losses; Strategy 4: Strategy 3 plus rebuilding Phase-II screens; and Strategy 5: Strategy 4 plus off-channel winter refuges.

[c] It has been assumed that it will ultimately be decided that YKPP steelhead will be outplanted above Roza Dam. This issue is currently being debated.

[d] "Enhancement" for steelhead includes the same measures listed for spring chinook.

[e] "Enhancement" for fall chinook includes the following strategies (modified from Draft Yakima Subbasin Plan): Strategy 1: implementation of YKPP

with existing habitat; Strategy 2: Strategy 1 plus halving open-river smolt losses; and Strategy 3: Strategy 2 plus increasing zero-density egg-to-smolt survival to 0.50. Note that new information leads to the decision to drop Strategy 4--the addition of new production area (Wanity Slough, Drain 4 and lower Toppenish Creek) to Strategy 3.

[f] For fall chinook and coho, estimates are that 80 percent or more of these species will be harvested before they reach the Yakima River.

[g] For planning purposes, "hypothetical existing" figures are used, but they serve no purpose here.

[h] "Enhancement" of summer chinook includes the following strategies (taken from the Yakima Subbasin Plan): Strategy 1: implementation of YKPP with existing habitat; Strategy 2: Strategy 1 plus halving open-river smolt losses; and Strategy 3: Strategy 2 plus renovating all Phase-II screens.

[i] "Enhancement" of coho includes the following strategies (taken from the Yakima Subbasin Plan): Strategy 1: implementation of YKPP with existing habitat; Strategy 2: Strategy 1 plus halving open-river smolt losses; and Strategy 3: Strategy 2 plus renovating Phase-II screens.

Halvina Open-River Smolt Losses: Cost

Specifying the cost of halving smolt losses in the Yakima River layers speculation on speculation.

First, a multi-year study must be conducted to determine the site-specific magnitudes and causes of smolt loss. The Experimental Design Work Group (EDWG) of the YKPP Hatchery Technical Work Group is currently in the initial stages of designing such a study, and the YKPP will almost certainly fund it. It is, however, very early to predict what the study will entail, and what it will cost. My highly speculative estimate of the cost of a two-year study is:

1st Year

1. 54,000 PIT-tags @ $3.50	$ 190,000
2. 2 PIT-tag detection systems, 2 floating smolt traps, 2 tag insertion systems, fish holding gear	92,000
3. Salaries	160,000

2nd Year

1. 54,000 PIT-tags @ $3.50	190,000
2. Salaries	160,000
TOTAL	$ 792,000

Second, one must divine the results of the study and then specify the nature and cost of the remedy. There is some evidence that predation, especially by squawfish, is the major cause of smolt loss in the system. Assuming the density of squawfish in the subbasin is equal to the largest observed, as many as 36,000 predatory squawfish may reside in the Yakima River. Using data from Rreman and Beamsderfer (1988), one can conservatively estimate that a 50 percent reduction in predatory mortality would require the removal of about 7,800 large squawfish annually: the "rule of thumb" being a "20 percent harvest of predators, by disproportionately cropping off the largest and most destructive fish, produces a 50 percent reduction in predation. Under this scenario, two full-time employees, equipped with a jet boat and provided with a GSA truck and expenses for fishing gear, could reasonably be expected to take 7,800 large squawfish per year. A highly provisional estimate of the annual costs of such an operation:

Salaries: (2 men)(160 hrs/mo)($8/hr)(12 mo/yr)	$ 30,720/yr
Fishing gear replacement	5,600/yr
Transportation	9,312/yr
Boat gas/maintenance	3,310/yr
	$48,942/yr

A jet boat and trailer could cost "$6,000. Assuming the boat and trailer are replaced every ten years, the cost of 50 years' predator control would be on the order of $2,477,100.

Rebuilding Phase-II Screens

The cost of re-screening the 53 "Phase-II" diversions listed in Appendix A table of the Power Council's Fish and Wildlife Plan has been estimated at $5,000,000 (Notice of proposed amendments to the Columbia River Basin Fish and Wildlife Program 88-28, December 20, 1988; see Appendix 4). Of this amount, $600,000 is for planning and design and $4.4 million for construction. The Application for Amendment did not list O&M or refurbishing costs, but these may be estimated as follows:

Design cost, 53 units	$ 600,000
Construction cost, 53 units	4,400,000
O&M, first 25 yrs.: (53 units)(25 yrs)($300/yr)	397,500
25-yr. refurbishing: ($4,400,000)(.0254)	111,760
O&M, second 25 yrs.: (53)(25)($300)	397.500
TOTAL 50-YR. COST	$ 5,906,760

Providing Off-Channel Winter Refuges

As the facilities to be used as winter refuges already exist, all that is necessary is salary for the employees to monitor the operation. Assuming two biologists would be needed for 20 hrs./wk. for 16 weeks, an annual salary budget might be: (20 hrs/wk)(16 wks/yr)($11/hr)(2 men) = $3,520/yr, Over 50 years, this would amount to $176,000.

Additional Habitat

Species Differences - 3 Possibilities

Cabin Cr., Manastash Cr., Ahtanum Cr., and Logy Cr. are all very viable candidates for steelhead restoration (Logy already has steelhead), but not for spring chinook. Cabin, Manastash and Ahtanum all have severe water problems (i.e., they dry up near their mouth) in the fall, when salmon spawn, but not in the spring, when steelhead spawn. Resolution of these water problems may not be possible for spring chinook. Lower Ahtanum Creek does not dry up until early August. If spring chinook can ascend beyond the dewatered reach soon enough, it would also be a strong candidate. Logy Creek is a tributary of Satus Cr. Satus Creek below Logy Cr. is somewhat like Ahtanum, in that it heats up to prohibitive levels by July: if salmon can reach Logy Cr. before July, then Logy is viable. The Teanaway system also has prohibitively low flows in the fall, and the scope of remedial measures is qualitatively greater for the Teanaway than for any other system. However, the production potential for the Teanaway system is so great, that planners have decided it will be brought back, even if on a permanent trap and haul basis. Consider, then the following scenarios for spring chinook.

MOST PROBLEMATIC MOST EXPENSIVE 5A	INTERMEDIATE LEVEL PROBLEMS INTERMEDIATE EXPENSIVE 5B	LEAST PROBLEMATIC LEAST EXPENSIVE 5C
Non-controversial areas	Non-controversial areas	Non-controversial areas
+ Cabin + Manastash + Ahtanum + Logy + Teanaway	+ Ahtanum + WY + Teanaway	+ Teanaway

Remember: All of these tributaries--Cabin, Manastash, Ahtanum, Logy and the Teanaway are viable candidates for steelhead.

Assume

% K = % other yields

K = 3,417,643 - UYN, strat 5 + T'way

439 , 259

3,856,902

	P	(1-P)
Cabin	= .OlO	.99
Teanaway	= .063	.937
Taneum	= .019	
Manastash	= .025	
Ahtanum	= .013	
Logy	= ,014	

Adding Teanaway:

$C - T'way = C_{TOT} - .063\ C_{TOT}$

$= C_{TOT}\ (1 - .063)$

$= C_{TOT}\ (.937)$:

$\frac{C - T'way}{.937} = C_{TOT}$;

$C_{T'way} = C_{TOT} - C - T'way$

$= \frac{C - T'way}{.937} - C - T'way$

$= C - T'way\ \left(\frac{1}{.937} - 1\right)$

$= C - T'way\ (.067)$

Strategy	Escapement to Subbasin	Sustainable Terminal Harvest	Terminal Harvest Rate	Total Harvest All Fisheries	Natural Spawning Escapement
5A	**20,896**	12,119	.58	16,765	7,021
+ T'way	**1,400**	**812**		**1,123**	470
	22,296	12,931	.58	17,887	7,491
5B	**Net fractional difference = Teanaway - Manastash - Cabin**				
			= .063 - .025 - .Ol		
			= .028		
			$C_{NET} = C - NET\left(\frac{1}{(1 - .028)} - 1\right) = C\text{-}NET\ (.029)$		
	20,896	12,119	.58	16,754	7,021
+ NET	602	1.351		586	204
	21,498	12,470	.58	17,250	7,225
5c	**Net fractional difference = .063** - .01 - .025 - .013 - .014				
			= .00l; **C-NET** $= \left(\frac{1}{(1 - .001)} - 1\right)$		
			= **.001**		
	20,896	12,119		16,764	7,021
+ NET	**21**	**12**		17	7
	20,917	12,131	.58	16,781	7,028

Thus, for these three strategies, would have three levels of production for spring chinook. Note that production for all other species would remain as listed on Table 1: these tributaries become problematic only for natural spawners that spawn in tributaries in the fall.

Full Cost of Strategies 5A, 5B, 5C

I. Strategy 5A

A. Cabin Cr.: All new monies - none obligated yet in any program.
NOTE: This is a possible "steelhead only" stream.

ladder = ($30,000/ft)(24/ft) = $720,000 Necessary for
blasting = ($853/day)(5 days) = 5,950 passage of spring
earth moving = (1,200/day)(30 days) = 36.000 chinook adults in fall.
$729,550

or, if trap and haul: (P. 26)

guard = $2,000/mo.
trailer = $400/mo.
hauler = $3,000/mo. - (truck driver)
use & mileage on
1500-gal. tanker = $350/mo.

Thus over a 3-month season:

(3 mo) [($2,000/mo) + $400/mo + 2($3,000/mo) + $350/mol

= $26,250 trap & haul operational costs
3,300 trap

$29,550 total cost, first year

OR, if for steelhead ONLY:

$5,950 for 5 days blasting.

B. Big Cr. (plus spill out constant 5 cfs for rearing) All new monies.
[Note: Unlikely to be "steelhead only"]

turnout device = $ 10,000
flow concentrators* = 33,520
upper fishway = 8,000
lower fishway = 5,000
screens** = 76,655

$133,175

*flow concentrators (p. 27):
(2640 ft)(100 ft/structure)($550/structure) = $14,520 installation
(0.5 mi)($760/mi/yr)(50 yrs) = 19,000 50-yr. maintenance

$33,520 total

**screens (p. 28):

Installation, upper dams: (9 cfs)($4500/cfs)	**=**	**$ 40,500**
Renovation, repair, lower dam	=	5,000
O/M, all screens, 50 yrs: 2 (50 yrs)($300)	=	30,000
25-yr. refurbishing	=	**1,155**
		$ 76,655

C. Teanaway System*: (Note: The Phase-II project has already obligate funds to make the Teanaway usable by steelhead; and Subbasin Planning or YKPP will make it usable by spring chinook.)

***See pp. 31-35.**

NOTE: Adequate instream flows throughout the year on the lower Teanaway would require an additional -17,000 AF. This water could be provided by a headwater impoundment, or by buying up "17,000 AF-worth" of water rights or land. If the instream flow problem is insoluble, adults could be trapped near the mouth and hauled above the dewatered zone ("trap-and-haul" operation).

Option 1: Dam. CH2MHILL estimates a 16,800 AF RCC Dam could be built at RM 6.2 of the Middle Fork Teanaway for $21,450,000. This dam would be 200 ft. high, and would inundate 2.1 mi. of stream and 172 acres of riparian land.

It has been estimated that the middle Fork should be usable by steelhead up to "RM 9.0 (spring chinook drop out below the dam, at ~RM 3.5). If a ladder were installed to give access to the 2.8 usable miles above the dam, an additional cost of (70,000/vertical foot)(200 ft) or $14,000,000 would be incurred.

TOTAL WITH DAM ONLY: $21,450,000
TOTAL WITH LADDERED DAM: $35,450,000.

Option 2: Buying Water Rights/Land. No information available.

Option 3: Trap and Haul. Operational expenses would be the same as for Cabin Cr.--$26,250/yr. A mobile trap could be built for "$6,600. Total costs first year = $32,850. Note: not adjusted for inflation, 50-year trap-and-haul costs are $1,312,500.

D. Taneum Creek (Note: All fishways and screens have been installed. **Thus, Taneum is currently usable by steelhead, and would be usable by spring chinook if the lower "3 miles were not dewatered in the fall.)**

NOTE: dewatering problem on lower Taneum could be solved by enlarging the delivery capacity of the South Branch KRD Canal and spilling more water into Taneum Cr. (Option 1), or by building a flow-augmentation reservoir on the South Fork of Taneum (Option 2), or by a trap-and-haul operation (Option 3). A fourth option, buying out water rights, has not been considered.

Note that lower Taneum Cr. is usually dry from about May 1 through mid-December, a period of 230 days, due to irrigation withdrawals. A rough rule of thumb is that all aquatic resources (except, perhaps, adult passage) will be protected if flows equal to or greater than 30 percent of the mean annual flow are maintained. The mean annual flow in Taneum Cr. is about 14 cfs. Thus, minimal flows should be 4.2 cfs. Providing these flows over 230 days would require (230 days)(4.2 cfs)(2 AF/cfs day) = 1,932 AF. Adult passage would, however, require additional water. A preliminary estimate of minimal passage flows for adult spring chinook on lower Taneum is 20 cfs. If this flow were provided for the month of September, an additional 948 AF would be required. Thus, to meet both rearing and passage requirements, a reservoir would need a capacity of 2,880 AF.

Option 1: Dam. CH MHILL estimates a 6800 AF earthfill reservoir at RM 2.8 on the so&h Fork of Taneum Cr. would cost $6,600,000, or $971/AF. At this rate, a 2,880 AF reservoir would cost $2.795.294.

As little habitat exists above RM 2.8 on the South For, there would be no laddering costs.

Size and cost for optimal rearing

Option 2: KRD Spill. Assuming the South Branch of the KRD Canal would have to deliver an additional 4.2 cfs to Taneum Cr. for 200 days--May 1 through August 31 and October 1 through December 15--and an additional 20 cfs for the 30 days of September, only one modification to the KRD system would be required: lining and shoring up a 1.2 mile section of canal. KRD estimates this would cost "$750,000. No additional costs would be required if Taneum Cr. were to be managed except dry October 15-December 15 for the optimal rearing flow of "20 cfs.

Option 3: Trap and Haul. The costs would be the same as for Cabin Creek: $26,250/yr. for operation, $3,300 for the trap.

E. Manastash Creek 19.3 cfs = Q, annual
13(19.3)≅ 5.8 cfs

All new monies.

NOTE: Manastash Cr. requires 2 fishways, 8 screens, and water for the lower 4.2 mi. (below KRD Canal) for a 230-day period. Note also, Manastash will be usable by steelhead with only fishways and screens. Manastash is not currently targeted by YKPP for spring chinook, although it may eventually be targeted for steelhead. The Subbasin Plan targets it for both spring chinook and steelhead.

1. Instream earth for passage, RM 4.9 = $ 1,000
   Notched, concrete weirs, RM 4.2 = 10,000
   Notched, concrete sills, RM 2.3 = 160.000

   Total = $171,000

2. Screening costs

New screen at RM 5.0 (6.2 cfs)($4,500/cfs)	= $ 27,900
New screen at RM 4.9 (20 cfs)($4,280/cfs)	= 85.600
New screen at RM 4.8 (2 cfs)($4,500/cfs)	= 9:ooo
New screen at RM 4.2 (25 cfs)($4,280/cfs)	= 107,000
New screen at RM 2.9 (5 cfs)($4,500/cfs)	= 22,500
New screen at RM 2.8 (3.5 cfs)($4,500/cfs)	= 15,750
New screen at RM 2.3 (10 cfs)($4,500/cfs)	= 145,000
New screen at RM 1.3 (10 cfs)($4,500/cfs)	= 45,000
Subtotal--all new installation	$357,750
O/M all screens, first 25 years 8(25)($300)	= $ 60,000
25-yr refurbishing ($357,750)(.0254)	= 9,086
O/M all screens, second 25 yrs.	= 60,000
TOTAL 50-yr. screen costs	$486,836

3. Instream flows.

At .3X mean annual flow, need rearing flows of 5.8 cfs for 200 days (May-August; and October-December 15), and passage flows of 25 cfs for September. Thus need 2,320 AF + 1,500 AF = 3,820 AF total.

There are seven possible ways of meeting this demand: construction of flow-augmentation dam (Option 1); increasing spill from KRD Canal by building re-regulating reservoir (Option 2); increasing spill from KRD by rebuilding Taneum siphon; increasing spill from KRD by a combination rereg/siphon program; buying water rights; or a combination of some or all of the preceding elements. Only the first two options--the dam and the re-regulating reservoir--have been evaluated. It should, however, be noted that the re-regulating reservoir scenario assumes the Taneum siphon is constantly run at or near maximum capacity, such that the reservoir does not have to provide 5.8 cfs for rearing except in the peak demand months of July and August. To be explicit, the re-regulating reservoir scenario assumes the siphon will pass enough water to provide rearing May through June and October through the end of irrigation season; and that the re-regulating reservoir will supply both rearing and passage water July through September.

Option 1: Dam. CH2MHill estimates a 7000 AF earthfill dam at RM 8.7 of the South Fork of Manastash Creek for $8,730,000, or $1247/AF. At this rate, a 3,820 AF reservoir could be built for $4,763,540. As steelhead are assumed to be able to utilize the South Fork up to RM 15.0, a ladder would have to be constructed to give access to the 6.3 miles above the dam. A 2,320 AF dam would be about 70 ft. high. At $70,000/vertical foot, the ladder would cost $4,900,000. The cost-benefit ratio for a steelhead ladder is thus very unfavorable.

Option 2: Re-requlatins Reservoir. The re-regulating reservoir would require a capacity of at least (62 days July-Aug)(5.8 cfs) (2 AF/cfs day) + (30 days, Sept.)(25 cfs)(2 AF cfs day) = 2,219 AF. If the costs of such a re-reg were comparable to the costs of a reservoir built in 1988 on Wasteway 6 of the Roza Irrigation District's Main Canal (~$5,000/AF), this project would cost $11,095,000.

Note:

(1) If, as seems probable, Taneum Cr. will be developed for spring chinook, the $750,000 for lining 1.2 mi. of the upper S. Branch Canal will have already been covered.

(2) Cost-sharinq possibilities

1. With IRD re. "skimming" from Big Cr. in spring;
re. re-regulating reservoir; (generates benefits)
re. increased water down Taneum Chute for hydropower

2. With DOT re. lining 1.2 mi of canal

TOTAL COSTS: Water:	$8,730,000 (dam) or	$11,095,000
SP CHK screens:	486.836	486,836
Fishways:	171:ooo	171,000
	$9,387,836	$11,752.836

Note: Also could trap and haul--$26,250/yr. plus "$4,000 for trap.

STH - Just screens and fishways, .'. $657,836

F. Cowiche Creek (Steelhead only)

Needs two fishways and 5 screens

1. Fishways

Alaska steep-pass at RM 3.9, SF = $4,646
Notched, concrete weirs, RM 4.4, SF = 8,000

$12,646

2. Screens

New screen at RM 7.5, mainstem: (2.7 cfs)($4,500/cfs)	= $12,000
New screen at RM 1.3, S. Fork: (2 cfs)($4,500/cfs)	= 9,000
New screen at RM 3.9, S. Fork: (3 cfs)($4,500/cfs)	= 13,500
New screen at RM 4.4, S. Fork: (6 cfs)($4,500/cfs)	= 27,000
New screen at RM 4.9, S. Fork: (3.8 cfs)($4,500/cfs)	= 17.100
Subtotal, installation	$78,600

O/M, all screens, first 25 yrs: 5(25)($300)	=	$ 37,500
25-yr. refurbishing, all screens: ($78,600().0254)	=	1,996
O/M, all screens, second 25 yrs: 5(25)($300)	=	37,500
TOTAL 50-yr costs		$155,596

TOTAL for COWICHE = $168,242

G. Wide Hollow Creek

All costs already paid by WDF

H. Ahtanum Creek (Both steelhead and sp. chinook)

Needs two fishways and seven screens. May also need two screens on Hatton and Bachelor Creeks. Lower 19 miles dries up in early August; spring chinook can probably clear.

(Two screens are covered under Phase II activities, as are 1, possibly 2, fishways.)

Screens:

RM 21.2, Mainstem, (3 cfs) x (4500/cfs)	=	$ 13,500
RM 22.9, Mainstem, (3 cfs) x (4500/cfs)	=	13.500
RM 2, North Fork (2 cfs) x (4500/cfs)	=	9:ooo
RM 3, North Fork (13 cfs) x (4280/cfs)	=	55,640
RM 3, South Fork (2 cfs) x (4500/cfs)	=	9.000
Subtotal		$100,640
O&M all screens, first 25 years, 5(25)($300)	=	$ 37,500
25-year refurbishings, $100,640(.0254)	=	2,556
O&M, second 25 years, 5(25)($300)	=	37.500
Total		$178,186

I. Simcoe Creek

1 screen, RM 14, Mainstem, (15 cfs) x (4280 cfs)	=	$ 64,200
1 screen at RM .5, North Fork, ((15 cfs) x (4280 cfs)	=	64,200
Subtotal		$128,400
First 25 years, O&M, 2(25)($300)	=	$ 15,000
Second 25 years, O&M, 2(25)($300)	=	15,000
Refurbishing, $128,400(.0254)	=	3,261
Total		$151,661

Need fishway at RM 14, Mainstem, $7000.

J. **Upper Toppenish Creek**

Culvert replacement: cleaning of downstream backwater	=	$ 17,460
Biologist's salary, indirect & vehicle	=	10,166
Rebuilding critical crossings	=	45,340
Total		$ 72,966

K. Logy Creek

Put in 2 miles of weirs to deepen flows.

2(5280)(1/100)($550/weir)	$ 58,080
50 years' maintenance, $760/mi/yr(2)(50)	76,000
Total	$134,000

KLICKITAT SUBBASIN

by David Lind

This part of the Appendix has four sections. These sections describe the requirements for spring chinook, summer steelhead, barrier removel, and the production plans for the Klickitat Subbasin.

Reuuirements for Spring Chinook

Stream: Klickitat River
Reach: Upper Cascade Springs (East Bank). River Mile 40.9
Size: Smolt
Number to release per year: 3,000,000
Number of years to release: Indefinite

The Yakima/Klickitat Production Project is currently in the predesign planning phase. Cost estimates are for the combined spring chinook and steelhead program in the Klickitat Subbasin which will be housed in a central facility. The programmed release of 3,000,000 spring chinook smolts includes the 750,000 smolts currently programmed for the WDF Klickitat Hatchery. Costs were estimated with the assumption that all Klickitat spring chinook would ultimately be reared at the new facility.

The central facility at upper Cascade Springs (East Bank) is estimatedd to cost $,4957,000, plus the unknown cost of about three acres of land currently owned by Plum Creek Timber Co. The total cost includes $1,331,000 estimated for a satellite facility for early rearing of steelhead, which is now deemed unncessary. Cost savings may result from combining all functions at one site. An adult trap at Falls #5 (RM 2.2) is roughly estimated to cost $250,000, assuming no cost for the land. $250,000 was also budgeted in the facility master plan for a second trapping site. This could be applied to the fish ladder at the existing WDF hatchery, but is doubled in this document to $500,000 to cover improvements in the hatchery fishway and possible construction of a rack atop the hatchery weir (note that this cost estimate addresses spring chinook action #4).

Total constructon cost is therefore estimated to be $5,707,000 for the central facility and two adult traps. A species breakdown is calculated in the worksheet on steelhead hatchery production.

Operation and maintenance costs are not broken down even by subbasin, but are estimated at $1,315,000 for the entire Yakima/Klickitat Production Project. The Klickitat facilities represent 37 percent of the overall capital cost estimate; applying this proportion to the operations and maintenance total results in an estimate of $490,000 per year to operate and maintain the Klickitat facilities for production of both species. A breakdown by species is calculated in the worksheet dealing with steelhead hatchery production.

[Source: (total costs only) Table 20 (pp. 51-52) of Yakima and Klickitat Rivers Central Outplanting Facility: Proposed Master Plan presented by

Fish Management Consultants of Olympia, Washington, to the NWPPC on July 10, 1987. More refined cost estimates will be avialable in July, 1989 (Paul Tappel, R. W. Beck and Associates, pers. comm.).]

Requirements for Summer Steelhead

Stream: Klickitat River
Reach: Upper Cascade Springs (East Bank), River Mile 40.9
Size: Smolt
Number to release per year: 250,000
Number of years to release: Indefinite

As explained in the spring chinook section, the facility cost estimate of $5,707,000, including the adult trap, is for the total spring chinook and steelhead program. Apportioning costs by species according to release numbers is incorrect since steelhead will be released at a larger size. If relative biomass at release is used to apportion costs (still an oversimplificaiton), steelhead production represents 19 percent of the total capital cost, or $1,084,000.

The operation and maintenance cost estimate in the hatchery master plan is for all species in both subbasins. A similar and admittedly oversimplified approach can be used to break down this estimate, using relative capital costs between subbasins, and relative biomass at release between species. This results in an estimated cost of $93,000 per year to carry out the steelhead program.

[Source: (total costs only) Table 20 (pp. 51-52) of Yakima and Klickitat Rivers Central Outplanting Facility: Proposed Master Plan presented by Fish Management Consultants of Olympia, Washington, to the NWPPC on July 10, 1987. More refined cost estimates will be available in July, 1989 (Paul Tappel, R. W. Beck and Associates, pers. comm.).]

Barrier Remove1

Stream: Klickitat River
Barrier Location: Castile Falls (RM 63.9-64.5)

Project Description

The present tunnels and open ladder were constructed between 1960 and 1963. The original design, as explained in the Klickitat Subbasin Plan, called for a single tunnel fishway, which could not be completed because of a subterranean mudflow. The Washington Department of Fisheries was forced to substitute a system of two tunnels and an open fishway to bypass five of the eleven falls, and three falls not bypassed by fishways were blasted to facilitate passage. There is little evidence of salmon or steelhead migration above the falls since construction was completed.

This is partly because the fishways have not been maintained well. Since the maintenance problem was last pointed out in mid-1988, WDF's Habitat

Management Division has taken over maintenance of these and other federal fishways from the Salmon Culture Division. The limited Mitchell Act funding available may still be insufficient for proper maintenance.

In addition to lack of maintenance, fishway design may be faulty. Our current understanding of the problems at Castile Falls is described below.

Upper Tunnel. Although it appears to be in good condition, little or no spawning occurs upstream of this structure. In September, 1988, adult spring chinook were observed below Falls #8, which must be negotiated along with Falls #9 in order to reach the mouth of the tunnel (the tunnel bypasses Falls #10 and Falls #11). Falls #8 and Falls #9 (were blasted in 1962 to facilaitate passage, but should be inspected at low flows--more work may be required. Fish may also avoid the tunnel itself, which is long, follows a V-shaped path, and is consequently dark. To treat an exit pool for the tunnel a ten-foot barrier dam was constructed at Falls #11, so adult migrants have no alternative route. In order to light the tunnel, a hydroelectric generator would have to be installed at the Falls #11 barrier. Providing 10 watts per foot would require 8.6 kilowatts. This in turn would require 13 cfs at 10 feet of head, assuming 80 percent efficiency, which is about 15 percent of the minimum river flow in this reach.

Middle Fishway. This open structure bypasses Falls #7. The fishway was dry in August, 1988, due to a lack of maintenance. Bed load was removed and new stop logs were installed in September. One of the fishway baffles was tipped over, creating a long pool with a steep drop above it. Stop logs on the baffles above and below this point were adjusted in an attempt to even out the drops. The height of the upper baffles in this fishway and the lack of attraction flow from the fishway at low and medium river flows are still considered to be problems. Falls #6 below this fishway was not judged to be a passage impediment at the time of construction.

Lower Tunnel. This 200-foot straight tunnel bypasses Falls #4 and Falls #5. Flow through the tunnel was minimal in August, 1988, but improved when gravel was cleaned out of the upstream end in September. Boulders remain in the river channel next to the upstream mouth of the tunnel. More importantly, the river is about 6 feet below the tunnel outlet at low flows. Falls #1 was blasted in 1963, but it was not deemed necessary to correct Falls #2 and Falls #3 just below the tunnel. These falls, along with the falls upstream, should be reevaluated during summer low flows.

Other Needs. Access roads to Catile Falls were improved in 1988, but access from the clifftops along the river to the passage structues will need to be improved.

Estimated Cost

Construction. The description of problems given above is incomplete. Any estimate of reconstruction cost must be based on an engineering inspection which takes into account seasonal flow fluctuations and the migration characteristics of spring chinook and steelhead. Therefore the only item

in the estimate is for a thorough inspection. If a total cost estimate is necessary, perhaps an upper bound can be established by adjusting the original $350,000 construction allocation for inflation between the years 1959 and 1990.

Engineering inspection of tunnels, ladder and 5 unladdered falls (20 man-days @ $400/day) = $8,000

Maintenance. The best current estimate is for two man-months per year. At $4,000 per man-month including supplies and transportation, this would cost $8,000 per year.

[Source: Based on discussions with Bud Robinson of the WDF Salmon Culture Division and Dan Stuckey of the WDF Habitat Management Division. cost estimates were estimated by the subbasin lead writer.]

Production Plans

Table 2.2 in Chapter 2 provides the planned production of spring chinook and summer steelhead for the Klickitat Subbasin.

APPENDIX D

SELECTED BIBLIOGRAPHY

Alward, G. S. 1987. IMPLAN Version 2.0: Constructing Regional Social Accounts with Data Reduction Methods. (Draft.) U.S.D.A. Forest Service General Technical Report RM-000, 00p. Fort Collins, Colorado: Rocky Mountain Forest and Range Experiment Station.

-----. 1987. IMPLAN Version 2.0: Methods Used to Construct the 1982 Regional Economic Data Base. (In press.) U.S.D.A. Forest Service General Technical Report RM-000, 00. Fort Collins, Colorado: Rocky Mountain Forest and Range Experiment Station.

----. 1987. Local and Regional Impacts of Outdoor Recreation Development. In The President's Commission on Americans Outdoors: A Literature Review. December, 1986: 47-57.

-----. 1987. Social Implications of Multiple-Use Forestry: Methods and Findings. Ljubljana, Yugoslavia: Proceedings of the VIIIth IUFRO World Congress.

[illegible]. 1986. A Generalized System for Regional Input-Output Analysis of Natural Resource Issues. SAF Symposium on Systems Analysis in Forest Resource Management, Society of American Forester Systems Analysis Workshop, (December, 1985). Athens, Georgia.

[illegible]. 1985. Extending the IMPLAN I/O System: The Social Accounting Matrix. A paper presented at the Midwest Forest Economist's Meeting (May 30-31, 1985). Ames, Iowa.

Alward, G. S., H. C. Davis, K. Despotakis, and E. Lofting. 1985. Regional Non-Survey Input-Output Analysis with IMPLAN. A paper presented at the Southern Regional Science Association Conference (May 9-10, 1985). Washington, D.C.

Alward, G. S., and K. Despotakis. 1987. IMPLAN Version 2.0: Data Reduction Methods for Constructing Regional Economic Accounts. (In press.) U.S.D.A. Forest Service General Technical Report RM-000, 00p. Fort Collins, Colorado: Rocky Mountain Forest and Range Experiment Station.

Alward, G. S., and E. M. Lofting. 1985. Opportunities for Analyzing the Economic Impacts of Recreation and Tourism Expenditures Using IMPLAN. Paper prepared for presentation at the Thirtieth Annual Meeting of the Regional Science Association. Philadelphia, Pennsylvania.

Alward, G. S., and C. Palmer. 1983. IMPLAN: An Input-Output Analysis System for Forest Service Planning. In R. Seppala, C. Row, and A. Morgan (eds.), Forest Sector Models: Proceedings of the First North American Conference on Forest Sector Modeling, 131-140. (Nov. 30-Dec. 4, 1981). Williamsburg, Virginia.

Alward, G. S., B. Sullivan, and T. Hoekstra. 1985. Using Socioeconomic Data in the Management of Fishing and Hunting. Transactions of the 49th North American Wildlife and Natural Resources Conference, 91-103.

Billings, R. B. 1969. The Mathematical Identity of the Multipliers Derived from Journal of Regional Science, 9, 3: 471-473.

Braschler, Curtis H. 1972. A Comparison of Least-Squares Estimates of Regional Employment Multipliers with Other Methods. Journal of Regional Science, 12: 457-468.

Bruckner, S. M., S. E. Hastings, and W. R. Latham. 1987. Regional Input-Output Analysis: A Comparison of Five 'Ready Made' Model Systems, The Review of Regional Studies, 17, 2: l-29.

Bucher, Willis, and Ratliff. 1985. Target Industry Market Analysis: Yakima County, Washington. Kansas City, Missouri: Consulting Engineers, Planning and Architects.

Bundy, M. M. 1988. An Economic Assessment of Maryland's Oyster Fishery. College Park, Maryland: University of Maryland, Maryland Sea Grant College Program.

-----. 1988. An Economic Evaluation and Trend Analysis of the Inshore Fisheries of the Mid-Atlantic Region. Annapolis, Maryland: Mid-Atlantic Fisheries Development Foundation, Inc.

California Advisory Committee on Salmon and Steelhead Trout. 1988. Restoring the Balance. Annual Report.

Carter, C. N., and H. D. Radtke. 1987. Economic Analysis of Impacts on Personal Income. Appendix 2d. Portland, Oregon: Oregon Department of Fish and Wildlife.

-----. 1986. Coastal Community Impacts of the Recreation/Commercial Allocation of Salmon in the Ocean Fisheries. Staff Report. Portland, Oregon: Oregon Department of Fish and Wildlife.

-----. 1986. Selected Economic Aspects of the Commercial/Recreational Allocation of Willamette River Spring Chinook. Staff Report. Portland, Oregon: Oregon Department of Fish and Wildlife.

Cordell, H. K., et al. 1987. The Background and Status of an Interagency Research Effort: The Public Area Recreation Visitors Survey (PARVS). Proceedings: 1986 Southeastern Recreation Conference. Asheville, North Carolina.

-----. 1982. The Public Area Recreation Visitor Survey: A Progress Report. (Mimeo.)

Donnelly, D. M., et al. 1985. Net Economic Value of Recreational Steelhead Fishing in Idaho. Resource Bulletin RM-9. U.S.D.A. Forest Service. Fort Collins, Colorado: Rocky Mountain Forest and Range Experiment Station.

East-Central Idaho Planning and Development Association, Inc. 1981. Loss of Fisheries Economic Adjustment Strategy.

Fish Management Consultants. 1987. Yakima and Klickitat Rivers Central Outplanting Facility, Proposed Master Plan. Prepared for Northwest Power Planning Council.

Glickman, Norman H. 1971. An Econometric Forecasting Model for the Philadelphia Region. Journal of Regional Science, 11, 1: 15-32.

Grossman, P. J. 1984. Economic Base Analysis: Theory and Application. Charlottesville, Virginia: University of Virginia.

Hall, Owen P., and Joseph A. Licari. 1974. Building Small Region Econometric Models: Extension of Glickman's Structure to Los Angeles. Journal of Regional Science, 14, 3: 337-353.

Henson, Steven E. and David E. Merrifield. 1987. An Econometric Employment and Income Model for Whatcom County, Washington. Department of Economics, Western Washington University. Mimeo (draft).

Hess, Samuel S., and Steven D. King. 1987. The 1987 Lower Columbia River (Bonneville to Astoria) and Estuary Salmon (Buoy 10) Recreational Fisheries. Oregon Department of Fish and Wildlife.

Horn, R. J., and J. R. Prescott. 1977. Central Place Models and the Economic Base: Some Empirical Results. Journal of Regional Science, (1978) 18, 2,: 229-241.

Hull-Griswold, Judy and Tim Cochnaeur. 1987. Job Performance Report, Project F73R8 Salmon and Steelhead Investigation. State of Idaho, Department of Fish and Game.

Hushak, L. J., G. W. Morse, and K. K. Apraku. 1987. Regional Impacts of Fishery Allocation to Sport and Commercial Interests: A Case Study of Ohio's Portion of Lake Erie. Columbus, Ohio: The Ohio State University, Ohio Sea Grant Program.

Hushak, L. J., et al. 1984. An Input-Output Analysis of the Economic Impact of Ohio's Lake Erie Fishery and Other Resources on a Northern Ohio Regional Economy. Technical Bulletin. Columbus, Ohio: The Ohio State University, Ohio Sea Grant Program.

Isserman, A. M. J. 1977. A Bracketing Approach for Estimating REGIONAL Economic Impact Multipliers and a Procedure for Assessing Their Accuracy. Environment and Planning Association, 9: 1003-1011.

-----. 1975. 'Regional Employment Multiplier: A New Approach'--Comment. Land Economics. (August 3, 1975) LI: 290-293.

Ives, E., and R. Youmans. 1978. Business Interrelationships of the Tillamook County Economy: A Study for Analysis of Economic Change. Corvallis, Oregon: Oregon State University, Agricultural Experiment Station.

Jensen, R. C. 1980. The Concept of Accuracy in Regional Input-Output Models. International Regional Science Review, 5, 2: 139-154.

Jensen, W., and H. D. Radtke. 1986. Recreational Fishing: A Conceptual Overview for Economic Impact Modeling.

[illegible]. Not Dated. Recreational Fishing: A Conceptual Overview of Economic Impact Modeling. Portland, Oregon: Lewis and Clark College.

-----. Not Dated. Sectoral Analysis of Economic Impacts: The Contribution of the Commercial Fishing Industry to Local Business Firms. Portland, Oregon: Lewis and Clark College.

Kim, U. S. 1985. Regional Development Impacts and Their Measurements. Fort Belvoir, Virginia: U.S. Army Corps of Engineers, Institute for Water Resources.

Kuehn, J.A., M. H. Proctor, and Curtis H. Braschler. 1985. Comparisons of Multipliers from Input-Output and Economic Base Models. Land Economics, 61: 129-135.

Latham, W. R., K. A. Lewis, and J.H. Landon. 1978. Regional Econometric Models: Specification of a Quarterly Alternative for Small Regions. Journal of Regional Science, (1979) 19, 1,: 1-13.

Lewis, C, W., and T. F. Glover. 1982. Linear Programming/Economic Base--Evaluation Model for Estimating the Regional Development Impacts of Water Resources Projects: User Manual. Fort Belvoir, Virginia: U.S. Army Corps of Engineers, Institute of Water Resources.

Liew, C. K., and C. J. Liew. 1982. The Multiregional Variable Input-Output Model for Evaluating the Impacts of Water Resource Projects on Regional Development: A Users Manual. Fort Belvoir, Virginia: U.S. Army Corps of Engineers, Institute for Water Resources.

Loveman, G. W., and Chris Tilly. 1988. Good Jobs or Bad Jobs: What Does the Evidence Say? New England Review (January/February).

Maki, W. R., D. Olson, and C. H. Schallau. 1985. A Dynamic Simulation Model for Analyzing the Importance of Forest Resources in Alaska. U.S.D.A. Forest Service. Pacific Northwest Forest and Range Experiment Station. Research Note PNW-432.

Merrifield, J. 1987. A Note on the General Mathematical Equivalency of Economic Base and Aggregate Input-Output Multipliers: Fact or Fiction. Journal of Regional Science, 27, 4: 651-654.

Meyer, P. A. 1982. Net Economic Values for Salmon and Steelhead from the Columbia River System. U.S. Department of Commerce. NOAA Technical Memorandum NMFS F/NWR-3. National Marine Fisheries Service.

Miernyk, W. H. 1987, Comment on 'Regional Input/Output Analysis: A Comparison of Five "Ready-Made" Model Systems.' Miscellaneous Paper No. 1188 of the Delaware Agricultural Experiment Station.

-----. 1965. The Elements of Input-Output Analysis. New York: Random House.

Miller, R. E., and P. D. Blair. 1985. Input-Output Analysis: Foundations and Extensions. Englewood Cliffs, New Jersey: Prentice-Hall, Inc.

Moe, R. J., R. C. Adams, and M. J. Scott. 1984. Master: A Forecast Model of Regional Economic Activity. In Analytic Techniques for Energy Planning, 165-184. North Holland: Elsevier Science Publishers B.V.

Morris, Kathleen, and Randy Anderson. 1988. Tourism in the Columbia Gorge: A Profile of Visitors' Accommodations and Economic Impacts. Washington Sea Grant Marine Advisory Services, University of Washington: Seattle, Washington.

National Marine Fisheries Service. 1984. Making Economic Information More Useful for Salmon and Steelhead Production Decisions. A workshop at Seattle, Washington. Environmental and Technical Services Division. NOAA Technical Memorandum NMFS F/NWR-8. Portland, Oregon.

Northwest Power Planning Council. 1987. Columbia River Basin Fish and Wildlife Program. Portland, Oregon.

-----. 1986. Northwest Conservation and Electric Power Plan, 1. Portland, Oregon.

Olson, D. C., W. R. Maki, and C. H. Schallau. 1985. IPASS Technical Manual. St. Paul, Minnesota: University of Minnesota, Department of Agricultural and Applied Economics.

Olson, D. C., C. H. Schallau, and W. R. Maki. 1984. IPASS: An Interactive Policy Analysis Simulation System. U.S.D.A. Forest Service. Pacific Northwest Forest and Range Experiment Station. General Technical Report PNW-170.

Oregon State University Department of Agricultural and Resource Economics. 1978. Socioeconomics of the Idaho, Washington, Oregon and California Coho and Chinook Salmon Industry. Final Report to the Pacific Fishery Management Council. Corvallis, Oregon: Oregon State University. Volume A, September, and Volume B (Chapters 10-13), October.

Oregon State University Extension Service. 1984. Sectoral Output Multipliers for Rural Counties. Corvallis, Oregon: Oregon State University.

Pacific Fishery Management Council. 1988. Review of 1987 Ocean Salmon Fisheries. Portland, Oregon.

-----. 1987. The Fishing Industry and Pacific Coastal Communities: Understanding the Assessment of Economic Impacts. Berkeley, California.: Sea Grant Extension, University of California.

-----. 1983. Proposed Plan for Managing the 1983 Salmon Fisheries Off the Coasts of California, Oregon, and Washington. Portland, Oregon.

Pacific Northwest- Electric Power and Conservation Council. 1988. Eighth Annual Report. Portland, Oregon.

Pacific Power. 1986. Target Industry Study: Central Washington. Portland, Oregon.

Pacific Salmon Management for People. 1977. Western Geographical Series, 13. Victoria, B.C., Canada: Department of Geography, University of Victoria.

Palmer, C., and E. Siverts. 1985. IMPLAN Analysis Guide. Fort Collins, Colorado: U.S.D.A. Forest Service, Land Management Planning Systems Section.

Petry, G. H. 1979. The Economic Status of the Oregon and Washington Non-Indian Salmon Gillnet and Troll Fishery. Pacific Northwest Salmon and Steelhead Fishery Report. Vol. 1 of 2. Pullman, Washington: Washington State University.

Petry, G. H., et al. 1980. The Economic and Employment Impacts Created by Commercial and Sport Salmon and Steelhead fishing in the Pacific Northwest. Pacific Northwest Salmon and Steelhead Fishery Report, Volume II. Prepared for the Pacific Northwest Regional Commission by College of Business and Economics. Pullman, Washington: Washington State University.

Pleeter, S. 1980. Economic Impact Analysis: Methodology and Applications. Boston: Martinus Nijhoff Publishing.

Radtke, H. D. 1988. Coastal Economics Model. Preliminary Draft. Prepared for Oregon Coastal Zone Management Assoc., Inc.

-----. 1984. Estimating Economic Impacts Associated with Recreational and Commercial Salmon and Steelnead Fishing. Paper prepared for National Marine Fisheries Service Workshop on Economic Information for Salmon and Steelhead Management. Seattle, Washington.

Radtke, H. D., and W. Jensen. 1986. The West Coast Seafood Industry: Its Importance to the West Coast Economy in 1986. Paper prepared for Pacific Marine Fisheries Commission. Portland, Oregon.

Richardson, H. W. 1985. Input-Output and Economic Base Multipliers: Looking Backward and Forward. Journal of Regional Science, 25, 4: 607-661.

Robison, H. M. 1988. An Input-Output Alternative to Community Economic Base Models: Technique and Review of a Recent Controversy. Draft. Moscow, Idaho: Department of Forest Resources, University of Idaho.

Robison, H. M. and D. T. Mormaechea. 1987. **Potential Employment Impacts of Anadromous Fish Habitat Management on the Payette National Forest. (Final Version.) McCall, Idaho: U.S.D.A. Forest Service, Payette National Forest.**

Rockland, D. B. 1986. **Economic Models: Black Boxes or Helpful Tools? A Reference Guide. Technical Report 2: SF1 Economics Program. Washington, D.C.: Sport Fishing Institute.**

Romanoff, Eliahu. 1974. **The Economic Base Model: A Very Special Case of Input-Output Analysis. Journal of Regional Science,** 14: 121-129.

Schalk, R. F. 1986. **Estimating Salmon and Steelhead Usage in the Columbia Basin Before 1850: The Anthropological Perspective. The Northwest Environmental Journal 2, 2:** 1-29.

Scott, M. J. Not Dated. A Fishery Manager's Guide to Understanding Secondary Economic Impact of Northwest Salmon and Steelhead. Battelle, Pacific Northwest Laboratories,

Scott, M. M., et. al. 1987. The Economic and Community Impacts of Closing Hanford's N Reactor and Nuclear Materials Production Facilities. Prepared for Battelle Memorial Institute, Pacific Northwest Laboratory, Hanford, Washington.

Siverts, E. 1987. **Economic Impact Assessment. A paper presented at the U.S.D.A. Forest Service's Social Science Workshop (April 14-16,** 1987). **Arlington, Virginia.**

-----. 1985. **Analytical Opportunities Using IMPLAN. A paper presented at the Midwest Forest Economist Conference (May 30-31,** 1985), Iowa **State University, Ames,** Iowa.

-----. 1983. **Uses of Input-Output Analysis in Forest Planning. A paper presented at the Midwest Forest Economists Conference (August** 29-31, 1983), **University of Wisconsin, Madison, Wisconsin.**

Siverts, E., G. S. Alward, J. Wagner, and K. Walters. 1987. **Interim IMPLAN Version 2 User's Guide. Fort Collins, Colorado: U.S.D.A. Forest Service, Systems Applications Unit, Land Management Planning.**

Siverts, E., C. Palmer, K, Walters, G. S. Alward. 1983. **IMPLAN User's Guide. Fort Collins, Colorado: U.S.D.A. Forest Service, Systems Application Unit, Land Management Planning.**

Sivitanidou, R. M., and K. R. Polenske. 1988. **Assessing Regional Economic** Impacts **with Microcomputers. American Planning Association Journal, (Winter** 1988) **101-106.**

Smith, F. J. 1978. **What Are Salmon Worth**? SG-48 **Oregon** State **University Extension Marine Advisory Program, Corvallis, Oregon.**

Smith, G. W., and H. T. Geier. T. 1986. A Profile of the Kittitas County Economy: Growth, Structure, and Cyclical Change, 1965-84. Pullman, Washington: Washington State University Cooperative Extension.

-----. 1986. A Profile of the Klickitat County Economy: Growth, Structure, and Cyclical Change, 1965-84. Pullman, Washington: Washington State University Cooperative Extension.

-----. 1986. A Profile of the Yakima County Economy: Growth, Structure, and Cyclical Change, 1965-84. Pullman, Washington: Washington State University Cooperative Extension.

Sorg, C. F., et al. 1985. Net Economic Value of Cold and Warm Water Fishing in Idaho. Resource Bulletin RM-11. Fort Collins, Colorado: U.S.D.A. Forest Service, Rocky Mountain Forest and Range Experiment Station.

Sorhus, C. N., W. G. Brown, and K. C. Gibbs. 1981. Estimated Expenditures by Salmon and Steelhead Sport Anglers for Specified Fisheries in the Pacific Northwest. Special Report 631. Agricultural Experiment Station. Corvallis, Oregon: Oregon State University.

Sport Fishing Institute. 1985. The Economic Impact of Sport Fishing in the United States. Washington, D.C.

-----. Not Dated. The Economic Impact of Sport Fishing in the United States. Washington, D.C. (Mimeo.)

-----. Not Dated. The Economic Impact of Sport Fishing in the State of Oregon. Washington, D.C.

----- Not Dated. The Economic Impact of Sport Fishing in the State of Washington. Washington, D.C.

Stabler, J. C., et al. 1988. Methodological Issues in the Evaluation of Regional Resource Development Projects. The Annals of Regional Science, 22, 2: 13-25.

State of Oregon, Department of Fish and Wildlife. 1989. Survey and Economic Impact Analysis of the 1988 Willamette Run Spring Chinook Sports Fishery. Prepared by The Research Group, Corvallis, OR.

State of Washington, Department of Community Development. 1988. Advisory Committee/Industry Responses to Report on Economic Impacts and Net Economic Values Associated with Non-Indian Salmon and Sturgeon Fisheries. Olympia, Washington.

----- 1988. Economic Impacts and Net Economic Values Associated with N&-Indian Salmon and Sturgeon Fisheries. Olympia, Washington.

Taylor, Carol A. 1982. Econometric Modeling of Urban and Other Substate Areas--An Analysis of Alternative Methodologies. Regional Science and Urban Economics, 12: 425-48.

Teeter, L., and G. S. Alward. 1987. An Interregional Input-Output Model of the U.S. Forest Economy. Proceedings of the Southern Forest Economic Workers (SOFEW) Meeting.

Thompson, J. C. 1980. An Empirical Note on the Compatibility of Central Place Models and Economic Base Theory. Journal of Regional Science, (1972) 22, 1: 97-103.

U.S.D.A., Forest Service. 1984. IMPLAN Briefing Document. Fort Collins, Colorado: Systems Application Unit, Land Management Planning.

U.S. Department of Commerce, Bureau of Economic Analysis, Regional Economic Analysis Division. 1975. The BEA Economic Areas: Structural Changes in Growth, 1950-1973. A Survey of Current Business, 2, 55 (November).

U.S. Department of Commerce. 1972. Obers Projections: Regional Economic Activity in the U.S., 1. Concepts, Methodology, and Summary Data. Washington, D.C.: U.S. Water Resources Council.

-----. Not Dated. 1980 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation: Washington. Fish and Wildlife Service, Bureau of the Census. Washington, D.C.: GPO.

U.S. Department of Commerce, National Marine Fisheries Service. 1988. Economic Activity Associated with Marine Recreational Fishing in 1985, Volume II--National and Regional Estimates. Prepared by Sport Fishing Institute.

-----. 1988. Economic Activity Associated with Marine Recreational Fishing in 1985, Volume III--Future Participation in Marine Recreational Fishing. Prepared by Sport Fishing Institute.

U.S. Department of Energy, Bonneville Power Administration, Office of Power Sales. 1987. Draft Environmental Assessment, Yaklma-Klickitat Production Project. Portland, Oregon.

West Coast Fisheries Development Foundation. No Date. Oregon's Commercial Fishing Industry: Its Importance to Oregon's Economy. Portland, Oregon.

Williams, M. L. 197. Kittitas County Socio-Economic Data Book. Ellensburg, Washington: Kittitas County Action Council, Inc.

Yakima County Development Association. 1987. Tourism marketing plan. Yakima County, Washington.

Youmans, R., W. Rompa, and E. Ives. 1977. The Tillamook County Economy: A Working Model for Evaluating Economic Change. Special Report 478. Corvallis, Oregon: Oregon State University Extension Service.

APPENDIX E

MATHEMATICAL SPECIFICATION OF THE INPUT-OUTPUT MODEL

Source: Hushak, L. J., et. al., Appendix A.

The transactions table is the basic foundation of the input-output model. It is from this table that the technical coefficients matrix is derived. The transactions table records total sales and purchases made by economic sectors of a given region during a given period of time, usually one year. Each economic sector is a producer of goods and services as well as a purchaser of goods and services for use in its production process.

The table shown in Figure Al represents an input-output transactions (gross flows) table. Entries in an input-output transactions table are arranged in rows and columns. Along each row is distributed the sales of a given producing sector to all other purchasing sectors and to final demand sectors. The columns show the purchases of a given sector from all other producing sectors and from primary input sectors.

As shown in Figure Al, the transactions table can be divided into four quadrants. Quadrant 1 represents final demand and contains all exogenous sectors which determine the level of output in the economy. The exogenous sectors are household expenditures, private investment, government expenditures and exports. Quadrant 11 represents the processing sectors. These are the endogenous sectors that sell their output to other processing sectors and final demand. Quadrant III represents the payment sectors. It includes payments to households in terms of wages, interest and profits; payment of taxes to governments; payments for imports, and capital consumption or depreciation. Quad rant IV represents the direct transactions between final demand sectors (Quadrant I) and payment sectors (Quadrant III). It shows the primary inputs and imports purchased directly by the final demand sectors.

The transactions table can be expressed by a linear equation system including sets of output equations, input equations, and identity equations:

$$(A\text{-}1)\quad X_i = \sum_{j=1}^{k} x_{ij} + \sum_{j=k+1}^{n} f_{ij} \;;\; \forall\, i=1,n$$

$$(A.2)\quad X_j = \sum_{i=1}^{k} x_{ij} + \sum_{i=k+1}^{m} r_{ij} \;;\; \forall\, j=1,m$$

$$(A.3)\quad X_i = X_j \;;\; \forall\, i=j;\; i,j=1,k$$

$$(A.4)\quad \sum_{i=k+1}^{m} x_i = \sum_{j=k+1}^{n} x_j \;;\; i=k+1,m;\; j=k+1,n$$

where,

X_i = total output of sector i

Figure Al. Input-Output Transactions Table

Output To / Inputs From		Purchasing Sectors 1 . . . . j . . . . n	Final Demand: Households	Private Investments	Government	Export	Total Gross Output
Producing Sectors	1	X_{11} ... X_{1j} ... X_{1n}	C_1	I_1	G_1	E_1	X_1
	.	Quadrant II	:	Quadrant I		:	:
	i	X_{i1} ... X_{ij} ... X_{in}	C_i	I_i	G_i	E_i	X_i
	n	X_{n1} ... X_{nj} ... Inn	C_n	I_n	G_n	E_n	X_n
Household		L_1 ... L_j ... L_n	u	L_I	L_G	L_E	L
Depreciation		D_1 .. Quadrant III .. D_n	D_C	Qudrant IV		D_E	D
Government		G'_1 ... G'_j ... G'_n	G'_C	G'_I	G'_G	G'_E	G'
Imports		M_1 ... M_j ... M_n	M_C	M_I	M_G	M_E	M
Total Gross Outlays		X_1 ... X_j ... X_n	c	1	G	E	X

X_j = total inputs used by sector j

$\Sigma_{j=1}^{k} x_{ij}$ = total intermediate output sold by sector i to itself and to all other endogenous sectors

$\Sigma_{i=1}^{k} x_{ij}$ = total intermediate inputs purchased by sector j from itself and from all other endogenous sectors

$\Sigma_{j=k+1}^{n} f_{ij}$ = total final demand for output of sector i

$\Sigma_{i=k+1}^{m} r_{ij}$ = total primary inputs purchased by sector j from all primary input sectors

Equation A.1 shows how the output of a given sector is used by k endogenous intermediate sectors ($\Sigma_{j-1}^{k} x_{ij}$) and n-k exogenous final demand sectors ($\Sigma_{j=k+1}^{n} f_{ij}$). The final demands include household purchases, exports, government purchases, gross inventory accumulation and gross private capital formation [Miernyk, 1965; Richardson, 1972; Jones, Jr., 1978]. The final demand sectors are the autonomous sectors which determine the level of output of an economy. The final demand sectors in a small economy's I-O model are in general summarized into four sectors: "Household," "Private Investment," "Government" and "Export" demand sectors; Figure Al. "household," "Private Investment" and "Government" sectors are often aggregated further into a single "Consumption" sector.

Equation A.2 shows input purchases by an endogenous sector from all other endogenous sectors ($\Sigma_{i=1}^{k} x_{ij}$) and primary input sectors ($\Sigma_{i=k+1}^{m} r_{ij}$). The primary inputs include payments to households in the form of wages, salaries, rental income, interest income and profits; payments to government; imports of goods and services; inventory depletion; and capital consumption or depreciation [Miernyk, 1965; Jones, Jr., 1978]. Primary input sectors of a small scale economy's I-G analytical system are commonly aggregated into Labor, Depreciation, Government and Imports. The first three sectors are often represented by a single "Value Added" sector.

The total amount of each primary input employed is subject to the constraint that the total amount of the primary inputs used by the k endogenous sectors be equal to the total amount of that resource available within the economy under consideration; i.e.,

$$\text{(A-5)}\quad \bar{r}_i = \Sigma_{j=1}^{k} r_{ij} \;;\; \forall\; i=k+1,m$$

where $\bar{r}_i$ stands for the total amount of primary input i available within the considered economy.

As an equilibrium condition of the economy under consideration, equation A.3 states that total output must be equal in value terms to

total inputs for a given endogenous sector. Equation A.4 simply shows that total final demand must be equal in value terms to total primary inputs for the entire economy in equilibrium. Equation A.4 further implies that as a whole the direct transactions between the final demand and primary input sectors must be in equilibrium. Stated by equations A.3 and A.4 together is then that for the entire economy in equilibrium the total input in value terms must be the same as the total output; i.e., $\Sigma_{i=1}^{m} Xi = \Sigma_{j=1}^{n} X_j$.

The Technical Coefficients Matrix

The matrix of the elements x_{ij} in the flow table is called the transtions matrix. From this transactions matrix, the technical coefficients matrix can be defined. The i,jth element of the technical coefficient6 matrix (a_{ij}) is

$$(A.6)\quad a_{ij} = x_{ij} / X_j \;;\forall\, i,j=1,k$$

The technical coefficient indicate6 what proportion of total inputs used by sector j is purchased from sector i, or it shows direct purchase of a given endogenous sector from itself and every other endogenous sector per unit of output.

By rewriting equation A.6 as $x_{ij} = a_{ij} X_j$, and imposing the identity equation A.3, equation A.1 can be restated as

$$(A.7)\quad X_i = \Sigma_{j=1}^{k} a_{ij} X_j + \Sigma_{j=k+1}^{n} f_{ij}$$

This equation shows the production relationship in the I-O table using the technical coefficients.

The technical coefficients matrix for primary inputs can be established in a similar way. The element of the technical coefficients matrix for the primary input (v_{ij}) is defined as

$$(A.8)\quad v_{ij} = r_{ij} / X_j \;;\; \forall\; i=k+1,m;\; j=1,k$$

It shows the amount of the primary input used as a proportion of total input by the jth endogenous sector. Since equation A.8 implies that $r_{ij} = v_{ij} X_j$, it follows from equation A.5 that

$$(A.9)\quad \bar{r}_i = \Sigma_{j=1}^{k} v_{ij} X_j \;;\; \forall\; i=k+1,m$$

where $\bar{r}_i$ is the total amount of the primary inputs available to all endogenous and exogenous sectors. Equation A.9 states the primary input

constraint on the whole economy under consideration in terms of the technical coefficients for primary input use.

The Interdependence Coefficients Matrix

Changes in the final demand have indirect effects in addition to direct effects on the sectoral outputs through successive round6 of transactions based on the interrelation of the endogenous sectors. The technical coefficient shows only the direct effect. The total effect as the sum of the direct and the cumulative indirect effects can be measured by interdependence coefficients.

The interdependence coefficient is defined from the technical coefficients matrix. Equation A.7 can be restated in matrix form as:

(A.lO) $X = AX + F$

where X = k x 1 column vector of sectoral total outputs (X_i)

A = k x k matrix of technical coefficients (a_{ij})

F = k x 1 column vector of total final demand $(F_i = \sum_{j=k+1}^{n} f_{ij})$.

Equation A.10 can be restated as:

(A.ll) $F = (I = A) X$, or

(A.12) $X = (I - A)^{-1} F$, or

(A.13) $X = BF$

where I is a k x k identity matrix, and B stand6 for $(I - A)^{-1}$, the k x k interdependence coefficients matrix with elements b_{ij}.

The matrix (I - A) in equation A.11 is called the Leontief Z-O matrix [Miernyk, 1965]. This matrix is inverted as in equation A.12 to obtain a matrix of direct and indirect requirements of intermediate inputs per dollar of final demand. The interdependence coefficient b_{ij} indicates the sum of the final demand change and direct and indirect change6 in the requirement6 of intermediate inputs used by the jth sector as a result of a one dollar change in final demand of the ith sector. The direct change6 in input requirements are given by the technical coefficients matrix A. The indirect change6 in input requirements can be obtained as B - (I + A), the total requirements less the initial change in final demand and the direct requirements.

The primary input constraint (equation A.9) can also be restated in matrix form as

(A.14) $R = VX$

where R is a (m-k) x 1 vector of total primary inputs available and V stands for the (m-k) x k matrix of the technical coefficients for primary input use with elements v_{ij}. Substitution of equation A.13 into equation A.14 yield6

(A.15) R = VBF, or

(A.16) R = ZF

where Z (=VB) is the matrix with the elements z_{ij}; i=k+1,m; j=1,k. The element z_{ij} shows the total change (direct and indirect) in the use of primary input i per one dollar change in final demand for the output of sector j.

Impact Coefficients (Multipliers)

The output multiplier indicates how total production will change throughout the economy as final demand is changed in any one sector of the economy. The output multiplier for a given endogenous sector j is

(A.17) $\lambda^{o}_{j} = \sum^{k}_{i=1} b_{ij}$

The output multiplier for sector j is the sum of the elements in column j of the interdependence coefficients matrix.

The employment multiplier for a given sector indicates total employment change6 in the economy resulting from a unit change in direct employment in that sector. The basic assumption underlying the employment multiplier is that, for each endogenous sector, a linear relationship exists between employment and output [Richardson, 1972; Jones, Jr., 1978]. The employment multiplier is computed from the direct and indirect employment effects estimated via an I-O model. The employment multiplier for a given sector j is

(A.18) $\lambda^{u}_{j} = (\sum^{k}_{i=1} (U_i / X_i)\, b_{i\,j}) / (U_j / X_j)$

where U is the employment of each endogenous sector.

The denominator in equation A.18 is average employment per unit of output in sector j, or the direct employment effect per unit change in final demand. The numerator is the sum of interdependence coefficients for sector i weighted by average employment per unit of output in each endogenous sector [Doeksen and Schreiner, 1974].

The most common I-O employment multipliers are the Type I and Type II. The employment multiplier defined here is the Type I. The Type II employment multiplier is the ratio of direct, indirect and induced, employment effects resulting from a unit change in final demand to direct effects. The direct, indirect, and induce4 employment effects are estimated by multiplying the column vector of the interdependence

coefficients matrix with the household sector endogenous by a row vector of average employment per unit of output in each endogenous sector. The direct and indirect effects for the Type I multiplier are estimated on the basis of the interdependence coefficients matrix with the household sector exogenous. For more details, see Jones, Jr. (1978), Palmer, et al. (1978), Richardson (1972), and Miernyk (1965).

The income multiplier measures the total change in income throughout the economy resulting from a unit change in income in a given sector in response to a final demand change. The basis of the income multiplier is that a certain amount of income is generated with each change in the output of each endogenous sector [Jones, Jr., 1978]. The income multiplier for a given sector j is the ratio of total (direct plus Indirect) income effect to direct income effect resulting from a change in final demand

$$(A.19)\quad \lambda_j^y = \left(\sum_{i=1}^{k} (Y_i / X_i)\, b_{ij}\right) / (Y_j / X_j)$$

where Y is income of individual endogenous sectors.

The direct income coefficient for sector j, the denominator in equation A.19, is the average income per unit of output in sector j. The total (direct plus indirect) income effect, the numerator in equation A.19, is obtained by multiplying the column vector of the direct input coefficients by average income for each sector [Doeksen and Schreiner, 1974].

There are Type I and Type II income multipliers, which are similar to Type I and Type IL employment multipliers. The income multiplier defined in equation A.19 is the Type I multiplier. The type II income multiplier is the ratio of the direct, indirect and induced income effects resulting from a unit change in final demand to the direct income effect. The Type I income multiplier is computed from the interdependence coefficients matrix with the household sector exogenous, while the Type II multiplier is estimated from the interdependence coefficients matrix with the household sector endogenous. For details, see Richardson (1972) and Jones, Jr. (1978).

Adjusted Impact Coefficients

In the estimation of the total economic impact of the Lake Erie economic sectors, the change must be measured by output rather than final demand. Several of the impact coefficients must be modified (adjusted) to obtain unbiased estimates of the total impacts when the change is measured by output rather than final demand: the output multiplier and the total and direct employment and income effects.

The output multiplier, λ_j^o, measures the total output change from a unit change in final demand. It includes the direct and indirect output produced as a result of the change in final demand in addition to the change in final demand. The direct and indirect output produced per

unit change in final demand is equal to the diagonal element of sector j minus one ($b_{jj} - 1$). The diagonal element (b_{jj}) is thus an appropriate deflator in order to convert the output multiplier to one which can be applied to output rather than to final demand. The adjusted output multiplier is defined as

$$(A.20)\quad \lambda_j^{o*} = \lambda_j^{o}/b_{jj} = \sum_{i=1}^{k} b_{ij}/b_{jj}$$

The employment (A.18) and income (A.19) multipliers are not affected by the measurement of change by output rather than final demand. However, the total effects (numerator) and the direct effects (denominator) of both multiplier are affected, because they are measured per unit of final demand. As with the output multiplier, deflation of the direct and total effects by the diagonal element b_{jj} converts the direct and total effects to adjusted direct and adjusted total effects which estimate these effects per unit of output:

$$(A.21)\quad \lambda_j^{u} = \left(\sum_{i=1}^{k} (U_i/X_i)(b_{ij}/b_{jj})\right) / ((U_j/X_j) / b_{jj})$$

$$(A.22)\quad \lambda_j^{y} = \left(\sum_{i=1}^{k} (Y_i/X_i)(b_{ij}/b_{jj})\right) / ((Y_j/X_j) / b_{jj})$$

Price Adjustment

Problems of the I-O model's static nature can be reduced through the price adjustment on the technical coefficients matrix. The out-of-date technical coefficients matrix (A_o) can be updated to a matrix for time t (A_t) by pre-multiplying by a diagonal matrix of price indices (P) for all endogenous sectors and post-multiplying by a diagonal matrix of the reciprocals of the price indices (P^{-1}) [Stone and Brown, 1962],

$$(A.23)\quad A_t = PA_oP^{-1}$$

This relative price adjustment multiplies each row by the price index for sector i and each column by the inverse of the price index for sector j. As a result of this adjustment, each technical coefficient (a_{ij}) is increased by the increased cost of purchasing from sector i (p_i) and decreased by the increased value of the output for sector j ($1 / p_j$); i.e., $a_{ij}^{t} = p_i\, a_{ij}^{o}\, (1 / p_j)$. In this price adjustment, it is assumed that price differences operate uniformly along rows [Czamanski and Malizia, 1969], that substitution of one product for another operates uniformly along the rows [Stone and Brown, 1965; Czamanski and Malizia, 1969], and that changes in the production function operate uniformly along the columns [Stone and Brown, 1962, 1965].

APPENDIX F

SPECIFICATION, ESTIMATION, AND SIMULATION OF THE ECONOMETRIC MODEL

In this appendix, the specification, estimation and simulation of the econometric model for the Kittitas, Klickitat and Yakima Counties are described in greater detail.

Specification

Specification of a regional econometric model involves two basic steps. First, key economic variables and the relationships between those variables need to be identified. Second, the functional form of the economic relationships modeled must be selected.

Selection of Economic Variables and Relationships

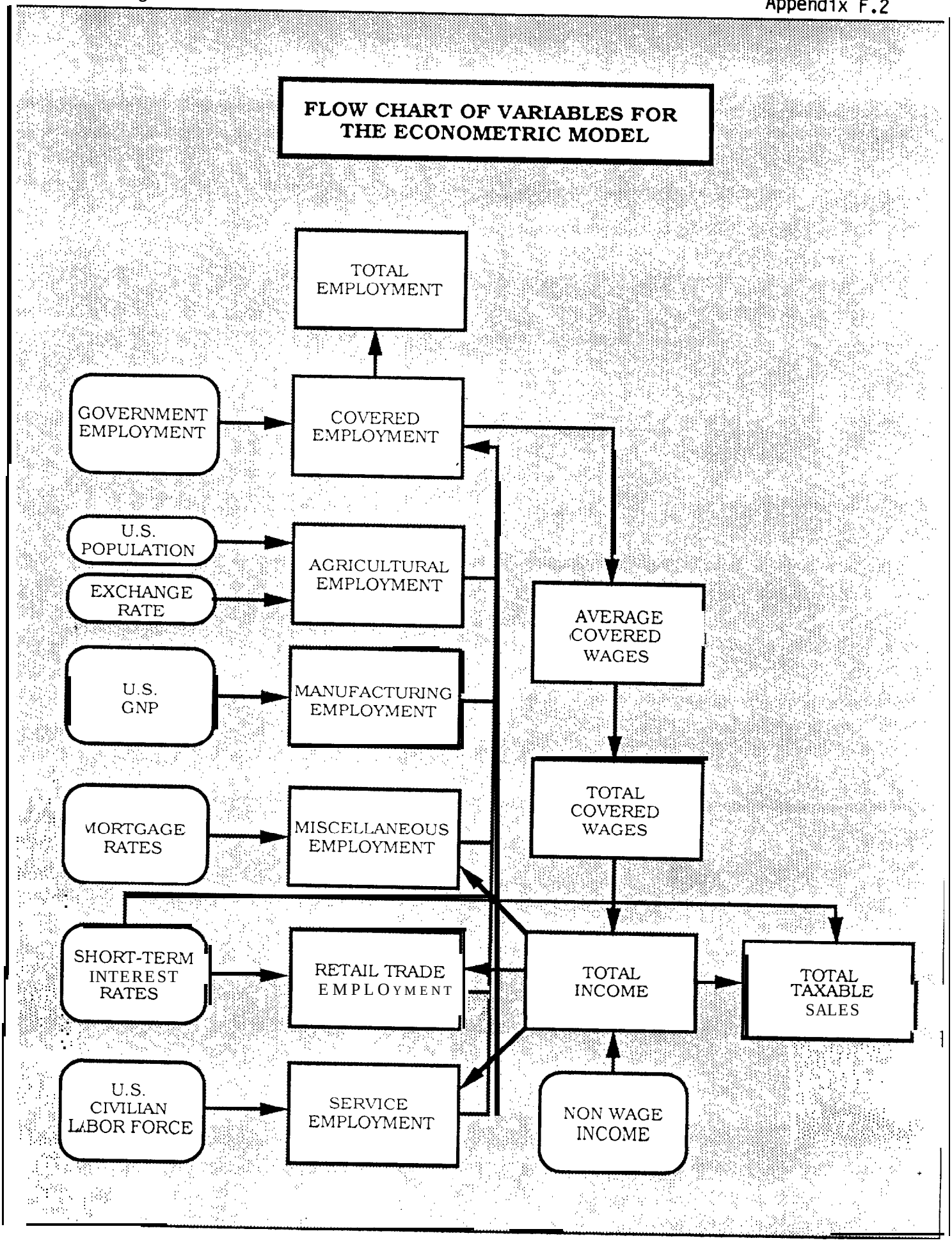
In analyzing a small regional economy, the paucity of data is a major factor in limiting the number of variables and relationships included in an econometric model. Little adequate time-series data exist on regional output and income. The most consistent source of time-series data on regional economic activity is covered employment and wage data. Covered employment data, collected because of unemployment and disability insurance coverage, has become the cornerstone of most regional analysis. Therefore, the model developed in this study is based on employment and wage relationships in the regional economy.

The causal relationships are summarized in Figure F.l. Endogenous variables are encased in boxes and exogenous variables are surrounded by ellipses. The arrows represent the assumed causal relationships between different variables.

Regional employment is broken down into six different sectors. These sectors are government, agriculture, manufacturing, retail trade, services, and a miscellaneous sector. The miscellaneous sector is the sum of construction; finance, insurance and real estate; mining; transporation, communication and utilities; and wholesale trade. Employment in the government sector is assumed to be exogenously determined, and employment in the remaining sectors is assumed to be endogenously determined.

The causal relationships in Figure F.l represent an export-base approach to regional economic activity. The basic sectors, agriculture and manufacturing, are assumed to be determined by external economic conditions and independent of regional incomes. Specifically, employment in the agriculture sector is assumed to be driven by U.S. population and the U.S.-Canadian real exchange rate. The U.S.-Canadian exchange rate is chosen because of competition of the region with Canadian apples and wheat. It also serves as a proxy for the U.S. exchange rate with other currencies and general U.S. competitiveness. The manufacturing sector is assumed to be a function of U.S. demand for the region's manufactured goods. U.S. demand is assumed to be primarily determined by U.S. real gross national product. Some allowance is made for the possibility of backward linkages between the miscellaneous sector, which includes construction, and the manufacturing sector.

Figure F.1.


FLOW CHART OF VARIABLES FOR THE ECONOMETRIC MODEL
TOTAL EMPLOYMENT
GOVERNMENT EMPLOYMENT
COVERED EMPLOYMENT
U.S. POPULATION
EXCHANGE RATE
AGRICULTURAL EMPLOYMENT
AVERAGE COVERED WAGES
U.S. GNP
MANUFACTURING EMPLOYMENT
TOTAL COVERED WAGES
MORTGAGE RATES
MISCELLANEOUS EMPLOYMENT
SHORT-TERM INTEREST RATES
RETAIL TRADE EMPLOYMENT
TOTAL INCOME
TOTAL TAXABLE SALES
U.S. CIVILIAN LABOR FORCE
SERVICE EMPLOYMENT
NON WAGE INCOME

The miscellaneous, retail trade, and service sectors are considered to be primarily non-basic sectors. Their activity is assumed to be a function of both external economic conditions and regional income. The miscellaneous sector, of which an important component is construction, is assumed to be driven by regional income and credit conditions in the long-term debt markets. The mortgage rate is used to represent long-term debt market conditions. Regional income and the short-term credit market conditions are assumed to determine retail trade employment. Conditions in the short-term credit markets are approximated by the three-month Treasury bill rate. Service sector employment is assumed to be related to regional incomes and, because of its labor intensive nature, regional labor market conditions. Regional labor market conditions are measured by the regional civilian labor force.

Government employment is assumed to be determined primarily by the political process and independent of both regional income and external economic considerations.

The model presented in Figure F.l determines regional income and employment simultaneously. The simultaneous determination of income and employment models the recirculation of spending in the non-basic sectors that results from changes in basic sector economic activity. The basic flow of the model is as follows. External economic conditions and government employment generate covered employment in the different sectors. Covered employment is obtained by summing employment over the different sectors. Real covered wages are calculated by multiplying average real wages by covered employment. Regional income is estimated by summing total covered wages with an estimate of the nonwage income received by the region's residents.[l] Regional income is then assumed to contribute to increased spending and employment in the non-basic sectors. Additional employment in the non-basic sectors increases wages, income and spending. This continues to generate new employment in the non-basic sectors.

In addition to estimating regional employment and income, estimates of total real taxable sales and total employment are calculated. Total real taxable sales are estimated directly as functions of short-term interest rates and regional income. Total employment is estimated by the historical ratio of total to covered employment.

Selection of Functional Form

The employment in the different sectors is modeled using a simultaneous disequilibrium framework. Firms in each sector are assumed to determine a desired employment level dependent on demand and cost considerations. Desired employment is not reached in every time period, but adjustments in current employment are made to try and reach the desired employment. In mathematical terms, desired employment in any given sector is assumed and is given by equation (1):

$$(1)\quad Y_t^* = \alpha + \beta X_t$$

where Y_t^* is desired employment at time t and X_t are explanatory variables including exogenous and endogenous variables. Actual employment is assumed to adjust in the following manner:

$$(2)\quad Y_t - Y_{t-1} = \delta(Y_t^* - Y_{t-1}) + u_t$$

where δ is the partial adjustment coefficient and u_t is a random disturbance term. Equation (2) states that employers will adjust employment from last period dependent on the deviation of last period's employment from desired employment. Larger values of δ indicate more rapid adjustment. Estimation of equation (1) is not possible because Y_t^* is not directly observable. Substituting equation (2) into equation (1), we can arrive at an estimable function:

$$(3)\quad Y_t = \alpha\delta + \delta\beta X_t + (1-\delta)Y_{t-1} + v_t$$

where v_t is a random disturbance term. In this functional form, this period's employment is a function of the endogenous and exogenous explanatory variables as well as last period's employment.

Other non-employment relationships are modeled using a simple linear specification of the form:

$$(4)\quad Y_t = \alpha + \beta X_t + v_t.$$

The econometric model consists of eight stochastic equations and three identities. The stochastic equations explain covered employment in the five non-government sectors, the average real covered wage rate, real taxable sales, and the ratio of covered employment to total employment. The three identities determine total covered employment, total real covered wages, total employment, and total real income.'

Data

Quarterly data are used to estimate the econometric model. Although the sample periods for different equations differ because of data availability, the data range from 1977, first quarter, to the third quarter of 1986. The regional economic data are summed for Kittitas, Klickitat, and Yakima counties. Table F.1 gives the variables names and descriptions used in the analysis. Table F.2 gives the means and standard deviations of the variables used in the analysis.

The employment data are collected by Washington State's Department of Employment Security. The data measure the total amount of covered employment in each of the sectors and includes both full-time and part-time employees subject to state unemployment and disability insurance programs. Total employment is Employment Security's estimate of the actual employment in the area and is used by the Department for the calculation of the local area's unemployment rate. In addition, Employment Security's estimate of the region's civilian labor force is used. These data are published monthly in Employment Security's 202 report.

Table F.l. Names and Descriptions of Variables Used in the Econmetric Model.

Series	Description
ENDOGENOUS VARIABLES:	
ETOT	Total Employment
ECOV	Covered Employment
EAG	Covered Agricultural Employment
EMAN	Covered Manufacturing Employment
EMIS	Covered Miscellaneous Employment
ERET	Covered Retail Trade Employment
ESER	Covered Service Employment
RATCT	Ratio of Total to Covered Employment
RWAV	Real Average Coverd Wage
RWCOV	Total Real Covered Wages
RY	Real Personal Income
SRTO	Total Real Taxable Sales
EXOGENOUS VARIABLES:	
CLF	Regional Civilian Labor Force
EGOV	Covered Government Employment
GNP82	U. S. Real Gross NAtional Product
PRAT	Real U. S. - Canadian Exchange Rate
QPCTWA	Percentage Wage to Personal Income
RI3MTB	Real Three-Month Treasury Bill Rate
RIAHE	U.S. Real Index of Hourly Earnings
RMORTR	Real Mortgage Rate
USPOP	U.S. Population

Table F.2. Means and Standard Deviations of Variables Used in the Econometric Model, 1978.2-1986.3.

Series	Mean	Standard Deviation
ENDOGENOUS VARIABLES:		
ETOT	31051.382	7112.4909
ECOV	73310.392	5374.2908
EAG	10954.069	3545.0330
EMAN	10272.275	1013.0176
EMIS	13850.441	1160.4164
ERET	12443.529	465.30747
ESER	12521.980	779.77488
RATCT	0.8081195	0.0665603
HWAV	3546.3310	285.47031
RWCOV	259374003	21616365.
RY	392798552	2.1795725.
SRTO	301873719	41225314.
EXOGENOUS VARIABLES:		
CLF	104385.89	6708.7934
EGOV	13268.098	567.54374
GNP82	3332961 8	199.35865
PRAT	3.2953946	0.1581683
QPCTWA	0.659'7055	0.0287940
RATCT	0.8081195	0.0665603
RI3MTB	9.5932411.	2.5562079
RIAHE	Il.5582571	0.0390620
RMORTR	13.134530	2.3609175
USPOP	232.41688	5.9299848

The wage data are also taken from Employment Security's 202 report and reflect the total wages paid to covered employees. Total covered wages and all other monetary values are deflated to 1982 constant dollars with the U.S. Consumer Price Index. Real average covered wages are then calculated by dividing total real covered wages by total covered employment.

Data on regional personal income collected by the Department of Commerce's Bureau of Economic Analysis are available only on an annual basis. If the nonwage component of income and the ratio of covered employment to total employment were relatively stable, it would be possible to use real covered wages as a substitute for real personal income. While the ratio of covered employment to total employment is relatively constant, the percentage of nonwage income has grown substantially in the area. In 1978, it was 25 percent of total income and grew to approximately 36% in 1986, Because the nonwage component has grown over time, we have developed our own estimate of real regional personal income. Our estimate is calculated by multiplying real covered wages each quarter by the corresponding year's percentage of personal income to wage income. This estimate of real personal income tends to understate actual real personal income because it does not include any estimate of wages paid to noncovered employees.

The remainder of the series, national estimates of real gross national product, three-month Treasury bill rates, mortgage rates, U.S. population, and real index of hourly earnings, is taken from the Washington State Department of Revenue, Economic and Revenue Forecast Council. Real rates of interest are calculated by subtracting the inflation rate from the nominal interest rates during the same period.

Estimation and Results

Consistent estimation of the parameters of the manufacturing, miscellaneous, retail trade, and service employment equations require two-stage least-squares. The remaining sectors are either entirely determined by exogenous variables or recursive and can be estimated using ordinary least-squares.

The data contain a substantial quarterly pattern, and some sectors demonstrate significant trends over time. To control for these patterns, quarterly dummy variables and trend terms are used where appropriate. Trend terms are included to capture the effects of unobserved variables that vary systematically over time. For example, they are used to capture the nation-wide movement away from a manufacturing towards a service base economy. In addition, dummy variables are included in the real average wage equation and the total real taxable sales equation. The dummy variable in the wage equation is zero prior to 1982 and is one after 1982. This is intended to capture changes in labor relationships stemming from the depth of th 1982 recession. The dummy variable in the sales equation is one when the sales tax was extended to include food and other items and is zero in other periods.

The estimated equations along with the diagnostic statistics are given in Tables F.3-F.10. Overall the model fits the data well. Adjusted R^2s range between .78 to .93. All the coefficients that are significant at the 95

Table F.3. Agricultural Sector Regression Results, Yakima, Kittitas, and Klickitat Counties.

Dependent Variable is EAG
Sample range: 1977.2 - 1986.3
Number of observations: 38

VARIABLE	COEFFICIENT	STD. ERROR	T-STAT.	2-TAIL SIG.
C	-711817.87	262828.25	-2.7083004	0.011
Q2	6414.3224	631.65855	10.154731	0.000
Q3	6853.5000	955.50306	7.1726614	0.000
Q4	991.34570	1159.7397	0.8548002	0.399
EAG(-1)	0.1346870	0.1952207	0.6899219	0.496
USPOP	3252.7499	1202.3151	2.7054055	0.011
T772	-1843.5152	701.29341	-2.6287360	0.013
PKAT	-186.05226	1734.9622	-0.1072371	0.915

R-squared	0.917982	Mean of dependent var	10605.84
Adjusted R-squared	0.898844	S.D. of dependent var	3577.012
S.E. of regression	1137.670	Sum of squared resid	38828799
Durbin-Watson stat	1.723897	F-statistic	47.96734
Log likelihood	-316.8243		

Table F.4. Manufacturing Sector Regression Results, Yakima, Kittitas, and Klickitat Counties.

Dependent Variable is EMAN
Sample range: 1978.1 - 1986.3
Number of observations: 35
Instrument list: C Q2 Q3 Q4 EMAN(-1) EMIS(-1) ERET(-1) ESER(-1) GNP82 RMORTR RI3MTB CLF T781

VARIABLE	COEFFICIENT	STD. ERROR	T-STAT.	2-TAIL SIG.
C	-5180.1407	929.35898	423.87116	1890.0884	-2.7406870	2.1925506	0.037	0.011
Q2	2166.3758	412.47221	5.2521740	0.000
Q3	2058.3759	281.91393	7.3014337	0.000
Q4	-0.0528945	0.1652647	-0.3200592	0.751
EMAN(-1)	5.4560300	0.9953788	5.4813606	0.000
GNP82	-0.0861740	0.1508568	-0.5712301	0.573
EMIS	-131.69580	26.501270	-4.9694144	0.000
T781				

R-squared	0.938844	Mean of dependent var	1.0249.30
Adjusted R-squared	0.922988	S.D. of dependent var	1007.218
S.E. of regression	279.5127	Sum of squared resid	2109438.
Durbin-Watson stat	1.748142	F-statistic	59.21318
Log likelihood	-242.2781		

Table F.5. Miscellaneous Sector Regression Results, Yakima, Kittitas, and Klickitat Counties.

Dependent Variable is EMIS
Sample range: 1978.1 - 1986.3
Number of observations: 35

VARIABLE	COEFFICIENT	STD. ERROR	T-STAT.	2-TAIL SIG.
C	-1296.2927	2516.4318	-0.5151313	0.611
Q2	2512.5480	671.31453	3.7427285	0.001
Q3	1583.4255	586.68763	2.6989243	0.012
Q4	512.12516	406.77467	1.. 2589398	0.218
EMIS(-1)	0.7446853	0.1720622	4.3280008	0.000
RY	1.109E-05	1.209E-05	0.9179763	0.366
RMORTR	-52.701768	24.770823	-2.1275743	0.042

R-squared	0.924780	Mean of dependent var	13820.45
Adjusted R-squared	0.908661	S.D. of dependent var	1156.913
S.E. of regression	349.6454	Sum of squared resid	3423053.
Durbin-Watson stat	1.871768	F-statistic	57.37359
Log likelihood	-250.7500		

Table F.6. Retail Trade Sector Regression Results, Yakima, Kittitas, and Klickitat Counties.

Dependent Variable is ERET
Sample range: 1978.1 – 1986.3
Number of observations: 35

VARIABLE	COEFFICIENT	STD. ERROR	T-STAT.	2-TAIL SIG.
C	-113.81999	1867.7582	-0.0609394	0.952
Q2	1152.2310	163.18055	7.0610804	0.000
Q3	762.85874	194.14941	3.9292355	0.001
Q4	401.92899	166.44955	2.4147196	0.023
ERET(-1)	0.8517055	0.1115120	7.6377942	0.000
RY	4.133E-06	3.442E-06	1.2007378	0.240
RI3MTB	-22.082054	14.563290	-1.5162820	0.141

R-squared	0.887586	Mean of dependent var	12418.09
Adjusted R-squared	0.863497	S.D. of dependent var	482.4950
S.E. of regression	178.2639	Sum of squared resid	889784.9
Durbin-Watson stat	2.110254	F-statistic	36.84654
Log likelihood	-227.1721		

Table F.7. Service Sector Regression Results, Yakima, Kittitas, and Klickitat Counties.

Dependent Variable is ESER
Sample range: 1978.1 - 1986.3
Number of observations: 35

VARIABLE	COEFFICIENT	STD. ERROR	T-STAT.	2-TAIL SIG.
C	-135.88191	1809.1508	254.78826	2415.5786 -0.5333131 0.7489513 0.598 0.460
Q2	-217.63376	293.34754	-0.7418973	0.465
Q3	-428.54842	225.96468	-1.8965283	0.069
Q4	0.4833040	0.1384485	3.4908563	0.002
ESER(-1)	8.758E-06	5.023E-06	1.7434930	0.093
RY	0.0078148	0.0144641	0.5402915	0.593
CLF	37.151947	12.533349	2.9642475	0.006
T781				

R-squared	0.928913	Mean of dependent var	12476.20
Adjusted R-squared	0.910484	S.D. of dependent var	814.5671
S.E. of regression	243.7128	Sum of squared resid	1603690.
Durbin-Watson stat	2.210410	F-statistic	50.40263
Log likelihood	-237.4811		

Table F.8. Ratio of total to Covered Employment Regression Results, Yakima, Kittitas, and Klickitat Counties.

Dependent Variable is RATCT
Sample range: 1978.2 - 1987.2
Number of observations: 37

VARIABLE	COEFFICIENT	STD. ERROR	T-STAT.	2-TAIL SIG.
C	0.7320348	0.0109676	66.745103	0.000
Q2	0.0441863	0.0131991	3.3476732	0.002
Q3	0.1042486	0.0147334	7.0756788	0.000
Q4	0.1619694	0.0136079	11.902598	0.000
AR(1)	0.2210252	0.1717668	1.2867744	0.207

R-squared	0.807225	Mean of dependent var	0.808343
Adjusted R-squared	0.783129	S.D. of dependent var	0.068759
S.E. of regression	0.032021	Sum of squared resid	0.032810
Durbin-Watson stat	1.975779	F-statistic	33.49923
Log likelihood	77.51611		

Table F.9. Real Average Wage Regression Results, Yakima, Kittitas, and Klickitat Counties.

Dependent Variable is RWAV
Sample range: 1977.2 - 1987.2
Number of observations: 41

VARIABLE	COEFFICIENT	STD. ERROR	T-STAT.	2-TAIL SIG.
C	1032.7406	539.08616	1.9157245	0.064
Q2	-152.06877	38.251137	-3.9755358	0.000
Q3	3.5625342	46.985802	0.0758215	0.940
Q4	231.17077	46.000376	5.0254105	0.000
RIAHE	107.88413	185.38279	0.5819533	0.565
RWAV(-1)	0.6967130	0.1059831	6.5738135	0.000
POST82	55.855561	51.709104	1.0801881	0.288
T-772	-8.7256561	3.2111863	-2.7172688	0.011
AR(1)	-0.0531546	0.0343191	-1.5488323	0.131

R-squared	0.942680	Mean of dependent var	3553.357
Adjusted R-squared	0.928350	S.D. of dependent var	294.9638
S.E. of regression	78.95462	Sum of squared resid	199482.6
Durbin-Watson stat	2.034960	F-statistic	65.78345
Log likelihood	-232.23.96		

Table F.10. Real Total Taxable Sales Regression Results, Yakima, Kittitas, and Klickitat Counties.

Dependent Variable is SRTO
Sample range: 1978.2 - 1986.4
Number of observations: 35

VARIABLE	COEFFICIENT	STD. ERROR	T-STAT.	2-TAIL SIG.
C	197816199	109406437	1.8080856	0.082
Q2	52250479.	10875143.	4.8045787	0.000
Q3	54807020.	15465327.	3.5438644	0.002
Q4	55032466.	12888992.	4.2697262	0.000
TAXDUM	22213817.	9286707.8	2.3920013	0.024
KY	0.2518879	0.2976261	0.8463234	0.405
RI3MTB	-1212566.0	1859451.8	-0.6521094	0.520
T782	-1772682.5	845568.35	-2.096439.1	0.046
AR(1)	0.7036260	0.1493630	4.7108455	0.000

R-squared	0.919929	Mean of dependent var	3.02E+08
Adjusted R-squared	0.895292	S.D. of dependent var	40648548
S.E. of regression	13153303	Sum of squared resid	4.50E+15
Durbin-Watson stat	2.159202	F-statistic	37.33909
Log likelihood	-618.1874		

percent level have signs consistent with a priori expectations about causal directions. Only two equations suffer from serious autocorrelation and both were reestimated using a the Cochrane-Orcutt procedure to correct for first-order autocorrelation.

Model Solution and Simulation

To judge the overall fit of the model, it is solved over the sample period 1978.1 to 1986.3. In solving the model, the exogenous variables take on their historical values, and these values are used to predict the values of the endogenous variables over time. Table F.ll gives mean percentage error, mean absolute percentage error, and the root mean squared error of the predictions. The predictive errors are relatively small. Over the sample period, the average error for any of the endogenous variables does not exceed 2 percent. Ignoring the offseting of positive and negative errors, the absolute average percentage error varies from under 2 percent to over 8 percent. The largest error is in predicting agricultural employment. This could be attributable to the quality of the agricultural employment data. Covered employment is a relatively poor measure of total agricultural employment compared to the other sectors. The average absolute error for total employment, income, and sales range from 2.4 percent to 4.2 percent.

Model Simulation

The indirect and induced impacts of the fishery enhancement project model on the three-county area are estimated by simulating the econometric model. Simulation involves several steps. First, a base line forecast of regional economic activity is made, For simplicity, all regional economic variables and dummy variables are assumed to remain constant over time. In addition, because it is difficult to forecast if certain employment trends will continue into the future, the trend terms are left at their 1986 third quarter values. The model is then simulated to give base forecasts for all endogenous variables.

Second, since the model is employment-based, all monetary direct impact figures need to be converted into employment. Specifically, a measure of the direct employment impact in affected sectors is created. This conversion is accomplished using IMPLAN's output to employment ratios. Since different sectors have different wage rates, the direct employment impacts in each sector are adjusted by the ratio of the wage in that sector to the average wage in the three-county area. The average was calculated for the last four quarters of the sample period. The wages and weights are given in Table F.12. The adjusted direct employment impacts are then added together for each of the study years.

Third, the direct employment impacts are added to the base-line government employment figures, and the model is simulated over the years 1990-2015. The total impacts of the proposed fishery enhancement project are calculated by subtracting the base line forecasts from the forecasts that

Table F. 11. Prediction Errors for Endogenous Variables in the Econometric Model, Yakima, Kittitas, and Klickitat Counties.

Series	Mean Percentage Error	Absolute Percentage Error	Mean Squared Error
ETOT	0.0050480	0.0248182	8994123.8
ECOV	0.0067466	0.0182893	4112607.7
EAG	0.0082723	0.0866728	1388508.7
EMAN	0.0012882	0.0189230	77993.264
EMIS	0.0152547	0.0391324	603538.3.1
ERET	0.0167377	0.0182799	75508.753
ESER	0.0081670	0.0177886	82814.241
RWAV	0.0063368	0.0187137	10184.401
RATCT	0.0026100	0.0306999	0.0013610
SRTO	0.0080313	0.0422188	2.598E+14
RY	0.0131341	0.0289893	2.455E+14

Table F.12. Average Wages by Sector for Yakima, Kittitas, and Klickitat Counties, 1985.3-1986.3.

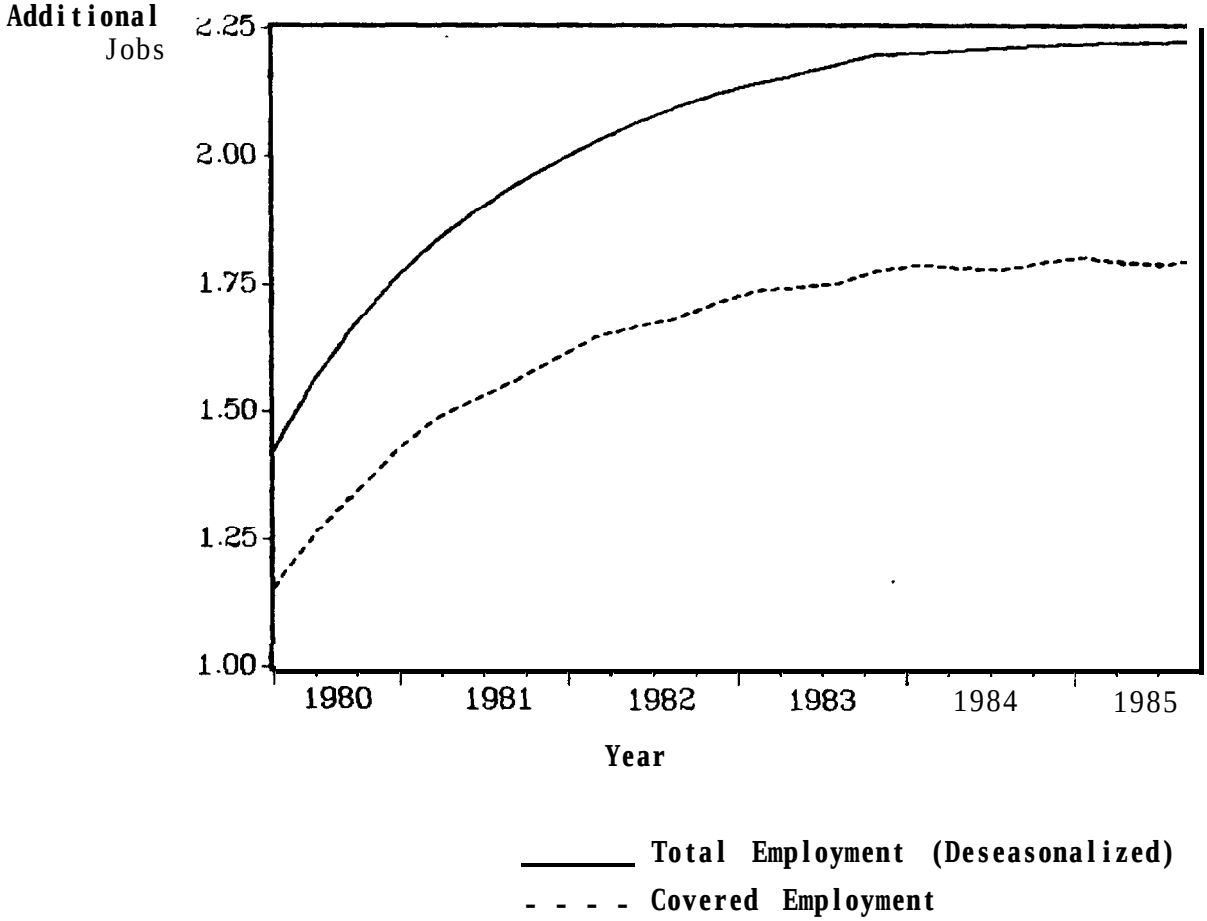
Sector	Heal Average Wage	Weighting Factor
Agriculture	$6,613	.51
Manufacturing	$18,985	1.45
Miscellaneous	$8,985	1.20
Retail Trade	$11,038	.69
Service	$15,646	.84
Government	$17,454	1.33
Total.	$13,084	

include the project. The results for the three-county area are given in Chapter 7. For comparison purposes, the model was simulated using the direct impacts for Kittitas and Yakima counties alone. These results are also presented in Chapter 7.

The model can also be simulated to demonstrate the time dynamics of the multipliers in the model. Changes in employment, income and sales do not reach their steady state levels instantaneously. To show how the model reacts to changes in external impacts, the model is simulated by adding 100 generic jobs to the regional economy in 1980. A generic job is a job that pays the going average regional real wage.

Figure F.2 shows the total and covered employment multipliers for 100 generic jobs. In the model, it takes approximately five years for all of the impacts of an external employment change to be fully reflected in regional employment. In the first year, the stimulus is approximately 1.4 for total employment and 1.2 for covered employment. At the end of five years, the multiplier for total employment has grown to about 2.3 and about 1.8 for covered employment.

Figure F.2. **Total and Covered Employment Impact Multipliers, Three-County Area (1978.2-1986.3).**



Notes

[1] This approach understates county personal income as measured by the Bureau of Economic Analysis. As is true in IMPLAN, this method fails to account for wages earned by workers not covered by unemployment and disability insurance. The data on non-covered employment is estimated by Employment Security but no estimates of non-covered wages are available.

APPENDIX G

A CATCH RATE HYPOTHESIS

A wide variety of variables could conceivably affect the catch rate. Two of the most important variables are the number of fish available to be caught and the amount of fishing effort expended in pursuit of the available fish. All other things equal, the number of fish caught per trip is likely to be positively correlated with the number of harvestable fish within the river system. (This assumption may not hold for situations where the number of fish in the system are relatively low compared to carrying capacity, i.e., at relatively low fish density levels, but the numbers of fish in the Yakima and Klickitat at projected 10-yar production levels are not likely to be low enough to make this possibility relevant for this discussion.) In turn, increasing catch rates (a quality dimension of recreational fishing) are almost certain to increase the demand for fishing trips. This means that, as information about increases in catch rates is disseminated, fishing effort is likely to increase; those who have been fishing the river system will increase their effort, and new fishers will be attracted from both inside and outside of the three-county region. As a result, competition among a growing number of fishers will increase, and this can be expected to reduce catch rates. Thus we have come full circle. An increase in the number of harvestable fish increases catch rates. This results in an increase in the amount of fishing effort expended by fishers. In turn, the increase in fishing effort reduces catch rates. The crucial question is: After all short-run adjustments have occurred, will catch rates be higher or lower than before the increase in the sustainable harvest of fish?

To answer this question, we broaden the discussion beyond considerng just the impacts within the study area. And since it is not uncommon for salmon and steelhead fishers to travel long distances to fish, we broaden our discussion to consider catch rates within the Pacific Northwest.

Given the mobility and willingness of salmon and steelhead fishers to travel, we believe that the long-run average river catch rates are not likely to vary dramatically from location to location within the Pacific Northwest. Underlying the reason for this is the fact that a combination of public agency information and word-of-mouth communications are efficient enough to disseminate catch rate information throughout the Pacific Northwest. (Of course this same information is likely to be disseminated beyond the Pacific Northwest to a relatively smaller number of potential fishers, but this does not detract from our argument; if anything it supports it.) In response to this information fishers will bypass areas with relatively low catch rates and concentrate their efforts on areas of relatively high catch rates. Nevertheless, some variation in catch rates should be expected. Possible reasons for this variation include population densities relative to travel distances to fishing sites, income level differences, and travel time constraints relative to employment and other commitments. To elaborate on the last reason, at one extreme a person wanting to fish in the evening after work may choose not to travel more than, for example, 30 miles from home to fish. At the other end of the spectrum, many retired people probably face relatively few significant time/distance constraints. This elaboration also serves as a reminder that all of the preceding considerations are interrelated. In summary, we would expect that, after short-run adjustments, the catch rates on the Klickitat

and Yakima rivers would vary only slightly from the range of existing catch rates for other Pacific Northwest rivers.

To be more specific, if anything, the long-run average catch rates for the Klickitat and Yakima rivers are likely to be slightly greater than for rivers like the Willamette that are located in or relatively near population centers. This is a logical extension of the preceding argument. However, existing overall Pacific Northwest catch rates will probably decline slightly during the next decade.

The reason for the latter assertion is simply that the demand for fishing trips has steadily increased during the last twenty years and is likely to increase further during the next decade. Demand determinants such as increases in real income, continued population growth, and changes in individual preferences away from hunting to fishing will all contribute to increased demand for fishing. If, due to increases in transportation, fishing equipment, and license costs, the overall cost of fishing increases during the next decade, the Law of Demand suggests that this will offset some of the demand increase just posited. Nevertheless, the domination of real income increases and population growth are almost certain to ensure that the net impact of all anticipated changes will be an increase in the number of sports fishing trips taken to harvest Pacific Northwest fish.

In summary, we are arguing that, after short-run adjustments to the increase in harvestable fish in the Klickitat and Yakima river systems, and if the sustainable harvest stabilizes, the catch rate will stabilize slightly above the averages for other Pacific Northwest river systems that are located near larger population centers. Furthermore, we do not expect long-run recreational catch rates for the Pacific Northwest as a whole to rise much above current levels. To support this contention we have argued that increases in the demand for fishing will, by definition, increase fishing effort and this will, in turn, offset increases in the sustainable harvest of fish. To say the same thing another way, even if short-run catch rates do rise above current levels for either the Klickitat/Yakima system or for the Pacific Northwest as a whole, we believe that behavioral responses of fishers and potential fishers will, as permitted by changes in harvest regulations, result in commensurate increases in fishing effort. And this increase in fishing effort will drive catch rates back down to or near current levels. Thus we maintain that, with only minor adjustments, historical catch rates are a good first approximation for the catch rate numbers that will be used for our sensitivity analysis.

APPENDIX H

ESTIMATION OF THE TRIP RATES AND CATCH RATES FOR YAKIMA INDIAN NATION TRIBAL FISHERIES

These estimates were provided by Steve Parker of the Yakima Indian Nation.

Projections of the number of trips per season and expected fishing success in Yakima tribal fisheries were based on the following general assumptions:

1. Trip characteristics for the Klickitat fishery take two forms: trips by local residents who may make daily trips to the fishing grounds for roughly 12-hour periods, and those who actually move to the fishing grounds for the duration of the "season" and camp there. For convenience, assume that a trip for these campers consists of one weekly fishing period which, for the Klickitat dip net fishery, is 4 days per week. During the closed 3-day period the campers typically leave the area.

   The Yakima River tribal fishery is conducted almost exclusively by local residents. There is essentially no camping at the fishing grounds.

2. Assume a "family unit" size of three individuals for campers at Klickitat Falls. This unit is more probably a group of fishers who are carpooling and camping together than a conventional family unit.

3. Average distance to and from fishing grounds:

   Klickitat River locals--assume 10 miles each way
   Klickitat River campers--assume 80 miles each way
   Yakima River locals--assume 20 miles each way

4. The mix of locals and campers at Klickitat Falls changes during the year. For example, the spring chinook fishery may see a 50/50 mix of locals and campers, whereas the mix in summer and fall months probably is closer to 25 percent locals and 75 percent campers. This pattern likely is a result of relatively low fish abundance during the summer months, and commercial fisheries on the mainstem Columbia River draw most local fishers away from the Klickitat in late summer and fall.

5. "Local knowledge" in the Klickitat fishery has been rewarded by assuming that locals are 1.5 times more likely than campers to catch a fish in a unit of time.

6. On the Klickitat, the spring chinook season is typically about 10 weeks in duration, and the majority of steelhead are caught in an 18-week period. The Yakima River spring chinook fishery is about 12 weeks long, and the fall fishery is about 10 weeks long. Note that there are no target steelhead fisheries for the tribe at current steelhead production levels.

7. Projecting harvest patterns at lo-year production levels is highly speculative. The harvest community could respond to increased fish abundance in two ways--as a numerical increase in fishers to some

equilibrium level determined by average fishing success, or as no increase in number but with an increase in average fishing success. The type of response likely will be different between the Yakima and Klickitat fisheries.

The Yakima River fisheries are underexploited at the present time, owing largely to recent declines in fishing effort. This is probably linked to a decrease in fishing success coincident with increased efficiency of fish passage at irrigation diversion dams where fishing activity is concentrated. Increased fish abundance by year 10 probably would produce a roughly proportional increase in numbers of fishers participating in tribal fisheries. It is assumed for year 10 projections that the number of trips/season will stabilize at the point where fishers are catching about two fish/trip. Note that this assumption excludes steelhead and coho, which will be taken incidentally in target fisheries for fall chinook.

Expansion of the Klickitat fishery, on the other hand, is space-limited. Within the physical confines of the tribal fishing area at Klickitat Falls, most of the productive fishing places presently are claimed. A significant increase in number of fishers able to participate in the fishery is therefore unlikely. It is expected that increased fish abundance by year 10 will mean higher average fishing success within a relatively stable population of Klickitat fishers.

Given these conditions, the following table is proposed. The first number given for trips to the Klickitat refers to local residents, and the second number refers to those who camp at the Falls. Recall that a trip for locals is defined as one 12-hour period, while a trip for campers is one 4-day period.

Location	Species	Expected No. Trips/Season		Expected Catch/Trip	
		Curr.	10-yr	Curr.	10-yr
Klickitat	Sp. Chin.	800/200	1000/250	.6/1.6	5.0/13.4
Klickitat	Steelhead	180/270	380/510	3.1/4.2	3.9/4.7
Yakima R.	Sp. Chin.	450	3000	1.2	2.0
Yakima R.	Steelhead	Incidental	1700	Incidental	3.3
Yakima R.	Su. Chin.	0	1200	0	2.0
Yakima R.	Fa. Chin.	50	1000	2.0	2.2
Yakima R.	Coho	50	1000	0.5	1.6

Tribal fisheries on the Klickitat and Yakima rivers are regulated by the Tribe based on pre-season assessments of run strength and harvest sharing agreements with state fisheries agencies. Tribal fishery regulations generally act to limit catch by limiting the time during which fishing may occur. Since the frequency of trips to tribal fishing grounds is related to the amount of time available for fishing, trip rates will be dependent

to some extent on harvest regulations designed to achieve a specified catch quota. The reader should note that no attempt has been made to anticipate harvest sharing agreements between state and tribal fishery managers at projected lo-year harvest levels, thus catch quotas or harvest shares implied by the projections on this table do not necessarily reflect harvest agreements reached by state and tribal fishery managers.

Using the above information we followed the steps listed below to estimate direct expenditures for Indian fish harvesting.

Table H.l shows terminal harvest projects, sport fishing harvest and Indian harvest. projections were based upon current harvest agreements governing the allocation of fish to Indian and sport fishing harvest.

Table H.l. Yakima Basin Enhancement Project, Native American Fishing.

Species	Terminal Harvest	Sport Harvest	Indian Fishery
Spring chinook	31,316	16,062	15,254
Summer chinook	4,866	2,466	2,400
Fall chinook	3,762	1,662	2,100
Steelhead	17,073	8,216	8,857
Coho	3,260	1,685	1,575
TOTAL	60,277	30,091	30,186

Table H.2 shows the Indian harvest by method of harvest. Projects were provided by the Yakima Indian Nation (Parker, 1989). The REGION model also includes the additional Columbia River fish, so the percentages do not correspond exactly with the Yakima Indian Nation projections, as we put the additional Columbia River fish into gill net harvest.

Table H.2. Yakima Basin Enhancement Project, Native American Fishing.

Species	Method of Harvest Dip Net	Rod & Reel	Gill Net
Spring chinook	10,907	2,669	1,678
Summer Chinook	1,920	480	
Fall chinook	1,680	420	
Steelhead	6,200	1,771	886
Coho	1,260	315	
TOTAL	21,967	5,656	2,564

Table H.3 shows assumed catch rates for the Indian fishery. These assumptions are based on interviews with Yakima Tribal officials (Parker, 1989). For the rod and reel harvest it was assumed that Indian fishermen would be approximately twice as successful as the average non-Indian sport fisher.

Table H.3. Yakima Basin Enhancement Project, Native American Fishing Catch Rates.

Species	Fish Per Day Dip Net	Rod & Reel	Gill Net
Spring chinook	2.0	0.33	10
Summer chinook	2.0	0.33	10
Fall chinook	2.2	0.33	10
Steelhead	3.3	0.33	10
Coho	1.6	0.33	10

Estimates of the gill net fishery catch rate were obtained from a Nez Perce fisheries person.

Table H.4 shows Indian angler days by method of harvest. These figures were derived by multiplying the harvest data (Table H.2) by the catch rates (Table H.3). Tribal sources indicated that the average Indian fishing party was three persons. Angler days were divided by the average party size of three persons to generate an estimate of the total number of Indian fishing trips.

Table H.4. Yakima Basin Enhancement Project, Native American Fishing Trips.

Species	Dip Net	Rod/Reel	Gill Net	Angler Days	Person/ Trip	Trips
Spring chinook	5,453	8,016	168	13,637	3	4546
Summer chinook	960	1,441	0	2,401	3	800
Fall chinook	764	1,261	0	2,025	3	675
Steelhead	0	5,320	89	5,408	3	1,803
Coho	768	946	0	1,733	3	578
TOTAL	7,965	16,984	257	25,204		8,402

Table H.5 shows assumed expenditures per trip for Indian fishing parties. It was assumed for the most part that Indian fishing parties would camp and cook out.

Table H.5. Yakima Basin Enhancement Project, Native American Fishing Expenditures Per Trip

Transportation	4.00
Groceries and Miscellaneous	10.00
Eating and Drinking	8.5
Boat Gas and Oil	5.00
Bait and Tackle	5.00
TOTAL	32.50

Table H.6 (Total Indian Fishing Expenditures) was derived by multiplying the total number of Indian fishing party trips (8,402) by the assumed expenditures per trip. The Direct total for Indian Fishing also included $16,750 for dip net fishing platforms. All other Indian capital expenditures were assumed to be expenditures outside the area.

Table H.6. Yakima Basin Enhancement Project, Native American Fishing Expenditures.

	($M)
Transportation	$33.607
Groceries and Miscellaneous	84.018
Eating and Drinking	71.415
Boat Gas and Oil	42.009
Bait and Tackle	42.009
TOTAL	$273.058

APPENDIX I

INPUTS AND RESULTS OF IMPLAN MODEL RUNS

Appendix I.2

Summary Impacts by Two-Digit Code for Each IMPLAN Model

REGIONAL MODEL
IMPACTS BY TWO DIGIT SIC CODE

CONSTRUCTION MODEL LOCAL CONTRACTOR	INDUSTRY OUTPUT (M)	VALUE ADDED (M)`	EMPLOYMENT
AGRICULTURE, FORESTRY AND FISH	**$585.259**	**$173.560**	23.53
MINING	**$1,227.124**	**$641.032**	**10.77**
CONSTRUCTION	$23,808.606	$7,138.825	146.24
MANUFACTURING	**$7,692.309**	**$2,451.806**	**69.29**
TRANSPORTATION AND UTILITIES	$3,623.941	$1,945.063	44.96
TRADE	**$3,844.259**	$2,196.247	**194.59**
FIRE	$4,439.003	$2,820.391	106.67
SERVICES	**$15,582.048**	$9,191.431	296.47
GOVERNMENT	$2,585.005	$1,456.601	47.57
TOTAL	$63,387.554	$28,014.955	940.08

TOTAL DIRECT IMPACTS	**$39,840.142**
TOTAL INDIRECT AND INDUCED IMPACTS	$63,387.554
TOTAL IMPACTS	$63,387.554
MEAN MULTIPLIER EFFECT	1.5910
MARGINED DIRECT IMPACTS	$39,816.758
GROSS MULTIPLIER	1.5920

REGIONAL MOOEL ANNUAL IMPACTS
IMPACTS 8Y TWO DIGIT SIC CODE

CONSTRUCTION MODEL LOCAL CONTRACTOR	INDUSTRY OUTPUT (M)	VALUE ADDED (MI	EMPLOYMENT
AGRICULTURE, FORESTRY AND FISH	**$117.052**	**$34.712**	$4.706
MINING	$245.425	$128.206	$2.153
CONSTRUCTION	**$4,761.721**	$1,42?.765	$29.247
MANUFACTURING	$1,538.462	$490.361	$13.858
TRANSPORTATION AND UTILITIES	$724.788	$389.013	$8.991
TRADE	$768.852	$439.249	**$38.919**
FIRE	$887.801	$564.078	$21.334
SERVICES	$3,116.410	$1,838.286	$59.294
GOVERNMENT	**$517.001**	**$291.320**	$9.513
TOTAL	$12,677.511	$5,602.991	$188.015

REGION CONSTRUCTION MODEL

OUT-OF-AREA CONTRACTOR	INDUSTRY OUTPUT (M)	VALUE ADDED (M)	EMPLOYMENT
AGRICULTURE, FORESTRY AND FISH	$427.959	$126.857	17.06
MINING	**$1,192.518**	**$622.911**	**10.46**
CONSTRUCTION	**$12,018.899**	**$3,586.477**	**74.58**
MANUFACTURING	$6,835.040	$2,221.155	61.30
TRANSPORTATION AND UTILITIES	**$2,868.763**	**$1,529.584**	37.52
TRADE	$3,013.080	**$1,720.173**	**161.91**
FIRE	**$3,328.833**	**$2,133.710**	**86.57**
SERVICES	$11,876.371	$6,985.440	229.17
GOVERNMENT	$21204.209	$1,257.975	40.76
TOTAL	$43,765.673	$20,184.282	719.33

TOTAL DIRECT IMPACTS	$27,498.604
TOTAL INDIRECT AND INDUCED IMPACTS	$43,765.673
TOTAL IMPACTS	$43,765.673
MEAN MULTIPLIER EFFECT	**1.5916**
MARGINED DIRECT IMPACTS	$27,476.630
GROSS MULTIPLIER	**1.5928**

REGIONAL MODEL ANNUAL IMPACTS
IMPACTS BY TWO DIGIT SIC CODE

CONSTRUCTION MODEL LOCAL CONTRACTOR	INDUSTRY OUTPUT (Ml	VALUE ADDED (Ml	EMPLOYMENT
AGRICULTURE, FORESTRY AND FISH	**$85.592**	$25.371	$3.413
MINING	**$238.504**	**$124.582**	$2.092
CONSTRUCTION	**$2,403.780**	$717.295	**$14.915**
MANUFACTURING	$1.367.008	**$444.231**	**$12.261**
TRANSPORTATION AND UTILITIES	$573.753	$305.917	$7.503
TRADE	**$602.616**	$344.035	**$32.381**
FIRE	$665.767	$426.742	$17.313
SERVICES	$2,375.274	$1,397.088	$45.834
GOVERNMENT	$440.842	$251.595	$8.152
TOTAL	**$8,753.135**	**$4,036.856**	**$143.865**

RIVER CONSTRUCTION MODEL
FIVE YEAR IMPACTS
OUT-OF-AREA CONTRACTOR

INDUSTRY	OUTPUT	VALUE ADDED	EMPLOYMENT
AGR, FOR.	$28.595	$5.354	0.65
MINING	$194.078	$60.318	1.75
CONSTRUCTION	$2,193.331	$776.417	23.85
MANUFACTURING	$762.794	$199.746	6.91
TRANS AND UTIL	$238.706	$80.825	2.83
TRADE	$451.353	$208.006	20.52
FIRE	$546.276	$45.830	2.93
SERVICES	$923.644	$364.146	21.30
GOVT.	$153.285	$59.913	2.93
TOTAL	$5,492.062	91,800.554	83.67

TOTAL INDIRECT AND INDU	1585.9622
TOTAL DIRECT IMPACTS	3910.1936
MEAN MULTIPIER	1.4045
TOTAL MARGINED DIRECT	3906.0997
GROSS MULTIPLIER	1.4060

RIVER CONSTRUCTION MODEL
ANNUAL IMPACTS

INDUSTRY	OUTPUT	VALUE ADDED	EMPLOYMENT
AGR, FOR.	$5.719	$1.071	0.13
MINING	$38.816	$12.064	0.35
CONSTRUCTION	$438.666	$155.283	4.77
MANUFACTURING	$152.559	$39.949	1.38
TRANS AND UTIL	$47.741	$16.165	0.57
TRADE	$90.271	$41.601	4.10
FIRE	$109.255	$9.166	0.59
SERVICES	$184.729	$72.829	4.26
GOVT.	$30.657	$11.983	0.59
TOTAL	$1,098.412	$360.111	16.73

KIYAK CONSTRUCTION MODEL
TWO DIGIT SIC CODE IMPACTS
OUT-OF-AREA CONTRACTOR

AGR. FOR.	$236.081	$58.673	3.39
MINING	$901.122	$446.184	7.48
CONSTR.	$9,150.331	$2,442.539	52.47
MANUF.	$5,676.301	$1,876.277	48.50
TRANS. & UTIL.	$2,495.682	$1,193.640	30.33
TRADE	$2,054.151	$1,175.110	112.68
FIRE	$2,193.149	$1,398.248	116.99
SERVICES	$8,033.426	$4,770.721	143.84
GOVT.	$1,928.863	$1,031.659	28.98
TOTAL	$32,669.106	$14,393.050	544.66

TOTAL DIRECT IMPACT	$22,295.668
GROSS MULTIPLIER	1.4653
TOTAL MARGINED IMPACTS	$22,278.218
TOTAL INDIRECT IMPACT	510,390.887
TOTAL DIRECT & INDIRECT IMPACT	$32,669.106
TOTAL MULTIPLIER EFFECT	1.4664

ANNUALIZED IMPACT

OUTPUT	OUTPUT	EMPLOYMENT	INCOME
AGR, FOR.	$47.216	$11.735	0.68
MINING	$180.224	$89.237	1.50
CONSTR.	$1,830.066	$488.508	10.49
MANUF.	$1,135.260	$375.255	9.70
TRANS. & UTIL.	$499.136	$238.728	6.07
TRADE	$410.830	$235.022	22.54
FIRE	$438.630	$279.650	23.40
SERVICES	$1,606.685	$954.144	28.77
GOVT.	$385.773	$206.332	5.80
TOTAL	$6,533.821	$2,878.610	108.93

Detailed Total Impacts by Sector

REGION HARVEST MODEL
SECTOR SPECIFIC IMPACTS

1989 DOLLARS IMPLAN SECTOR	INDUSTRIAL OUTPUT (M)	VALUE ADDED (M)	EMPLOYMENT
1 DAIRY FARM PRODUCTS	$20.126	S4.495	5.61
2 POULTRY AND EGGS	S13.128	81.120	0.11
3 RANCH FED CATTLE	$1.388	so.127	0.01
4 RANGE FED CATTLE	$96.523	SO.596	0.05
5 CATTLE FEEDLOTS	$91.901	$8.865	0.69
6 SHEEP, LAMBS AND GOATS	$3.113	so.284	0.02
7 HOGS, PIGS AND SWINE	53.019	SO.276	0.02
8 OTHER MEAT ANIMAL PRODUCTS	SO.958	80.088	0.01
9 MISCELLANEWS LIVESTOCK	S2.324	80.330	0.04
11 FOOD GRAINS	81.911	so.649	0.04
12 FEED GRAINS	$68.035	$22.481	0.52
13 HAY AND PASTURE	86.438	82.127	0.05
14 GRASS SEEDS	so.153	30.067	0.00
16 FRUITS	$19.275	$9.788	0.67
17 TREE NUTS	so.791	SO.483	0.03
18 VEGETABLES	$34.002	821.396	0.71
19 SUGAR CROPS	30.000	$0.000	0.00
20 MISCELLANEOUS CROPS	$2.169	SO.963	0.02
22 FOREST PRODUCTS	80.270	$0.199	0.00
23 GREENHOUSE AND NURSERY PRODUCTS	S2.256	$1.066	0.14
24 FORESTRY PRODUCTS	SO.611	SO.274	0.00
26 AGRICULTURAL, FORESTRY, FISHERY	$9.243	S3.818	0.32
27 LANDSCAPE AND HORTICULTURAL SERV	87.263	$5.160	0.24
33 SILVER ORES	00.000	$0.000	0.00
45 CRUSHED AND BROKEN LIMESTONE	$0.444	SO.242	0.00
47 CRUSHED AND BROKEN STONE, N. E.	SO.781	SO.423	0.01
48 CONSTRUCTION SAND AND GRAVEL	$5.639	$2.791	0.05
58 MISC. NONMETALLIC MINERALS, N.E.	SO.076	80.036	0.00
66 NEW RESIDENTIAL STRUCTURES	$0.000	to.000	0.00
67 NEW INDUSTRIAL AND COMMERCIAL BU	$0.000	$0.000	0.00
68 NEW UTILITY STRUCTURES	S100.807	816.167	0.17
69 NEW HIGHWAYS AND STREETS	$0.000	so. 000	0.00
70 NEW FARM STRUCTURES	$0.000	$0.000	0.00
72 NEW GOVERNMENT FACILITIES	80.000	$0.000	0.00
73 MAINTENANCE AND REPAIR, RESIDENT	914.790	$9.472	0.29
74 MAINTENANCE AND REPAIR OTHER FAC	$1,211.601	9348.356	9.63
75 MAINTENANCE AND REPAIR OIL AND G	80.000	$0.000	0.00
79 SMALL ARMS	so.001	80.000	0.00
82 MEAT PACKING PLANTS	$226.930	822.502	0.54
87 CHEESE, NATURAL AND PROCESSED	83.820	90.364	0.01
90 FLUID MILK	S19.644	84.639	0.06
91 CANNED AND CURED SEA FOODS	80.640	SO.156	0.01
93 CANNED FRUITS AND VEGETABLES	$23.310	$5.859	0.08
94 DEHYDRATED FOOD PRODUCTS	84.387	$1.146	0.03

95	PICKLES, SAUCES, AND SALAD DRESS	$2.759	SO.581	0.01
97	FROZEN FRUITS, JUICES AND VEGETA	$19.700	$3.905	0.13
103	PREPARED FEEDS, N.E.C	8428.587	S70.292	0.92
106	BREAD, CAKE, AND RELATED PRODUCT	813.372	$6.091	0.39
112	MALT LIQUORS	59.275	S1.902	0.03
114	WINES, BRANDY, AND BRANDY SPIRIT	$11.087	$1.655	0.05
115	DISTILLED LIQUOR, EXCEPT BRANDY	S12.206	$1.092	0.02
116	BOTTLED AND CANNED SOFT DRINKS	$22.861	$5.519	0.12
117	FLAVORING EXTRACTS AND SYRUPS, N	$6.476	S2.795	0.02
122	ROASTED COFFEE	822.558	S4.437	0.07
123	SHORTENING AND COOKING OILS	SO.320	SO.037	0.00
125	MACARONI AND SPAGHETTI	S1.389	SO.421	0.01
126	FOOD PREPARATIONS, N.E.C	$41.707	S15.694	0.17
131	BROADUOVEN FABRIC MILLS AND FIN1	so.275	SO.067	0.00
151	APPAREL MADE FROM PURCHASED MATE	39.195	$3.261	0.43
152	CURTAINS AND DRAPERIES	so.755	SO.223	0.01
155	CANVAS PRODUCTS	so.577	SO.214	0.01
156	PLEATING AND STITCHING	so.079	SO.027	0.00
160	LOGGING CAMPS AND LOGGING CONTRA	317.483	85.152	0.05
161	SAWMILLS AND PLANING MILLS, GENE	S23.565	$8.084	0.25
162	HARDWWD DIMENSION AND FLOORING	81.072	SO.256	0.01
163	SPECIAL PRODUCT SAWMILLS, N.E.C	SO.036	SO.016	0.00
164	MILLWORK	39.110	92.251	0.11
165	WOOD KITCHEN CABINETS	SO.065	SO.024	0.00
166	VENEER AND PLYWOOD	s5.468	81.777	0.07
167	STRUCTURAL WOOD MEMBERS, N.E.C	so.393	so.111	0.01
168	PREFABRICATED MOOD BUILDINGS	so.001	$0.000	0.00
169	WOOD PRESERVING	$5.734	91.291	0.06
170	WOOD PALLETS AND SKIDS	81.708	SO.602	0.02
172	WOOD PRODUCTS, N.E.C	s11.368	S3.552	0.16
173	WOOD CONTAINERS	SO.067	80.024	0.00
174	WOOD HOUSEHOLD FURNITURE	S4.631	81.868	0.10
177	UPHOLSTERED HOUSEHOLD FURNITURE	95.249	32.029	0.13
179	MATTRESSES AND BEDSPRINGS	s3.331	so.949	0.03
183	WOOD PARTITIONS AND FIXTURES	80.012	so.005	0.00
194	BAGS, EXCEPT TEXTILE	51.916	SO.506	0.01
199	PAPERBOARD CONTAINERS AND BOXES	S29.948	$8.349	0.18
200	NEWSPAPERS	$76.581	833.913	1.00
201	PERIODICALS	$1.444	SO.387	0.02
204	MISCELLANEOUS PUBLISHING	$1.182	so.688	0.02
205	COMMERCIAL PRINTING	816.422	S7.217	0.23
210	ENGRAVING AND PLATE PRINTING	SO.060	so.034	0.00
213	PHOTOENGRAVING	30.020	so.011	0.00
215	INDUSTRIAL INORGANIC, ORGANIC CH	$65.809	819.749	1.90
216	NITROGENOUS AND PHOSPHATIC FERTI	$4.092	81.186	0.03
218	AGRICULTURAL CHEMICALS, N.E.C.	$2.706	SO.839	0.01
224	CHEMICAL PREPARATIONS, N.E.C	s1.103	so.331	0.01
225	PLASTICS MATERIALS AND RESINS	so.315	so.090	0.00
229	DRUGS	SO.631	SO.285	0.00
231	POLISHES AND SANITATION GOODS	SO.232	80.067	0.00

232 SURFACE ACTIVE AGENTS	SO.877	SO.297	0.00
234 PAINTS AND ALLIED PRODUCTS	so.687	SO.219	0.00
238 PAVING MIXTURES AND BLOCKS	97.699	82.265	0.02
243 FABRICATED RUBBER PRDDUCTS, N.E.	so.007	80.003	0.00
244 MISCELLANEOUS PLASTICS PRODUCTS	82.574	30.945	0.02
255 GLASS AND GLASS PRODUCTS, EXC CO	30.343	SO.156	0.01
267 CONCRETE BLOCK AND BRICK	$0.000	sO.OOO	0.00
268 CONCRETE PRODUCTS, N.E.C	so.222	80.090	0.00
269 READY-MIXED CONCRETE	S4.612	$1.299	0.03
276 MINERALS, GROUND OR TREATED	SO.053	SO.012	0.00
280 BLAST FURNACES AND STEEL MILLS	80.075	SO.026	0.00
285 IRON AND STEEL FOUNDRIES	$0.000	$0.000	0.00
292 PRIMARY ALUMINUM	81.858	SO.469	0.01
294 SECONDARY NONFERROUS METALS	40.507	SO.099	0.00
297 NONFERRWS ROLLING AND DRAWING,	$3.234	80.480	0.03
303 METAL CANS	so.539	SO.165	0.00
306 PLUMBING FIXTURE FITTINGS AND TR	SO.176	80.066	0.00
307 HEATING EQUIPMENT, EXCEPT ELECTR	80.755	SO.304	0.01
308 FABRICATED STRUCTURAL METAL	so.775	so.286	0.01
309 METAL DOORS, SASH, AND TRIM	$1.702	SO.587	0.02
310 FABRICATED PLATE WORK (BOILER SH	SO.102	80.042	0.00
311 SHEET METAL WORK	31.975	so.731	0.01
312 ARCHITECTURAL METAL WORK	30.101	SO.049	0.00
313 PREFABRICATED METAL BUILDINGS	80.134	SO.040	0.00
320 HAND AND EDGE TOOLS, N.E.C.	80.004	SO.002	0.00
322 HARDWARE, N.E.C.	SO.428	SO.204	0.01
323 PLATING AND POLISHING	SO.016	SO.008	0.00
327 PIPE, VALVES, AND PIPE FITTINGS	$3.910	91.625	0.01
329 FABRICATED METAL PRODUCTS, N.E.C	SO.697	SO.263	0.01
332 FARM MACHINERY AND EQUIPMENT	$1.236	SO.435	0.01
335 MINING MACHINERY, EXCEPT OIL FIE	30.000	$0.000	0.00
340 INDUSTRIAL TRUCKS AND TRACTORS	SO.116	SO.041	0.00
343 SPECIAL DIES AND TOOLS AND ACCES	50.004	SO.002	0.00
347 FOOD PRODUCTS MACHINERY	82.031	so.884	0.02
350 PAPER INDUSTRIES MACHINERY	so.334	90.122	0.00
352 SPECIAL INDUSTRY MACHINERY, N.E.	92.208	so.865	0.04
355 BLOWERS AND FANS	SO.032	50.012	0.00
361 MACHINERY, EXCEPT ELECTRICAL, N.	80.144	SO.070	0.00
362 ELECTRONIC COMPUTING EQUIPMENT	SO.004	80.002	0.00
386 ELECTRIC LAMPS	80.057	80.021	0.00
392 RADIO AND TV COMMUNICATION EQUIP	80.012	30.006	0.00
395 ELECTRONIC COMPONENTS, N.E.C.	$3.631	81.245	0.03
398 X-RAY APPARATUS AND TUBES	SO.671	80.250	0.01
402 TRUCK TRAILERS	80.097	80.025	0.00
404 MOTOR VEHICLE PARTS AND ACCESSOR	$0.000	$0.000	0.00
405 AIRCRAFT	$0.001	30.000	0.00
407 AIRCRAFT AND MISSILE EQUIPMENT,	80.515	30.240	0.00
408 SHIP BUILDING AND REPAIRING	80.018	SO.009	0.00
409 BOAT BUILDING AND REPAIRING	$1.055	SO.279	0.01
412 TRAVEL TRAILERS AND CAMPERS	$3.534	SD.884	0.08

413 MOBILE HOMES	$2.747	SO.612	0.02
417 MECHANICAL MEASURING DEVICES	so.266	so.147	0.01
420 SURGICAL APPLIANCES AND SUPPLIES	$0.154	SO.080	0.00
424 OPHTHALMIC GOODS	92.907	SI.699	0.04
426 JEWELRY, PRECIOUS METAL	SO.096	so.020	0.00
430 MUSICAL INSTRUMENTS	so.091	SO.042	0.00
432 DOLLS	$0.000	80.000	0.00
433 SPORTING AND ATHLETIC GOODS, N.E	$382.600	$169.497	5.20
436 MARKING DEVICES	$0.052	80.021	0.00
444 SIGNS	$7.980	83.801	0.10
445 MANUFACTURING INDUSTRIES, N.E.C.	80.094	80.039	0.00
446 RAILROADS AND RELATED SERVICES	87.710	S3.879	0.08
447 LOCAL, INTERURBAN PASSENGER TRAN	812.454	$8.058	0.22
448 MOTOR FREIGHT TRANSPORT AND WARE	9121.413	869.099	1.89
449 WATER TRANSPORTATION	$8.417	31.852	0.04
450 AIR TRANSPORTATION	$62.568	818.015	0.21
451 PIPE LINES, EXCEPT NATURAL GAS	86.581	83.657	0.01
452 TRANSPORTATION SERVICES	37.614	93.334	0.17
453 ARRANGEMENT OF PASSENGER TRANSPO	9102.218	855.122	2.60
454 COMMUNICATIONS, EXCEPT RADIO AND	$199.701	8161.359	2.18
455 RADIO AND TV BROADCASTING	$114.798	852.559	0.99
456 ELECTRIC SERVICES	$304.269	$137.604	1.20
457 GAS PRODUCTION AND DISTRIBUTION	$55.809	810.691	0.12
458 WATER SUPPLY AND SEWERAGE SYSTEM	82.356	81.104	0.06
459 SANITARY SERVICES AND STEAM SUPP	$27.990	916.474	0.51
460 RECREATIONAL RELATED WHOLESALE T	9646.777	8350.683	2.85
461 OTHER WHOLESALE TRADE	$150.099	$81.384	39.40
462 RECREATIONAL RELATED RETAIL TRAD	$3,948.846	$2,274.137	129.77
463 OTHER RETAIL TRADE	9615.765	8354.619	17.30
464 BANK1 NC	9143.375	880.989	2.26
465 CREDIT AGENCIES	846.232	934.801	1.59
466 SECURITY AND COMMODITY BROKERS	316.545	811.986	0.17
467 INSURANCE CARRIERS	354.974	813.579	0.58
468 INSURANCE AGENTS AND BROKERS	317.171	910.873	0.27
469 OWNER-OCCUPIED DWELLINGS	8102.189	965.406	0.09
470 REAL ESTATE	8345.471	S233.995	11.90
471 HOTELS AND LODGING PLACES	$2,012.432	$877.390	72.36
472 LAUNDRY, CLEANING AND SHOE REPAI	841.744	S22.647	1.29
473 FUNERAL SERVICE AND CREMATORIES	S5.785	$2.126	0.12
474 PORTRAIT AND PHOTOGRAPHIC STUDIO	523.485	S14.244	0.38
475 ELECTRICAL REPAIR SERVICES	S14.085	S8.943	0.15
476 WATCH, CLOCK, JEWELRY AND FURNIT	'52.822	$2.046	0.03
477 BEAUTY AND BARBER SHOPS	S27.362	819.298	0.86
478 MISCELLANEOUS REPAIR SHOPS	S21.572	816.295	0.33
479 SERVICES TO BUILDINGS	828.131	821.910	1.27
480 PERSONNEL SUPPLY SERVICES	$24.964	821.109	0.41
481 COMPUTER AND DATA PROCESSING SER	867.521	850.373	0.51
482 MANAGEMENT AND CONSULTING SERVIC	$412.070	S269.765	8.00
483 DETECTIVE AND PROTECTIVE SERVICE	911.633	S8.838	0.44
484 EQUIPMENT REPAIR AND LEASING	398.615	571.122	0.47

485 PHOTOFINISHING, COMMERCIAL PHOTO	S22.983	814.646	0.29
486 OTHER BUSINESS SERVICES	832.513	820.514	1.11
487 ADVERTISING	$6.602	$4.608	0.12
488 LEGAL SERVICES	$91.264	357.990	1.02
489 ENGINEERING, ARCHITECTURAL SERVI	s193.400	8129.273	2.59
490 ACCOUNTING, AUDITING AND BOOKKEE	827.240	820.247	0.51
491 EATING AND DRINKING PLACES	$1,757.047	$642.771	50.33
492 AUTOMOBILE RENTAL AND LEASING	$45.349	$21.907	0.63
493 AUTOMOBILE REPAIR AND SERVICES	5213.163	$90.133	1.84
494 AUTOMOBILE PARKING AND CAR WASH	35.870	83.290	0.15
495 MOTION PICTURES	$6.640	S2.564	0.29
496 DANCE HALLS, STUDIOS AND SCHOOLS	SO. 635	SO.352	0.05
497 THEATRICAL PRODUCERS, BANDS ETC.	$4.667	82.343	0.09
498 BOWLING ALLEYS AND POOL HALLS	97.628	S3.523	0.35
499 COMMERCIAL SPORTS EXCEPT RACING	so.988	so.533	0.05
500 RACING AND TRACK OPERATION	95.511	$2.258	0.05
501 MEMBERSHIP SPORTS AND RECREATION	$6.670	82.140	0.40
502 AMUSEMENT AND RECREATION SERVICE	s351.168	8194.356	11.62
503 DOCTORS AND DENTISTS	8365.517	8220.673	3.82
504 HOSPITALS	9213.281	$108.192	5.45
505 NURSING AND PROTECTIVE CARE	$44.060	S24.329	1.46
506 OTHER MEDICAL AND HEALTH SERVICE	$85.783	843.130	1.35
507 ELEMENTARY AND SECONDARY SCHOOLS	824.495	811.299	1.90
508 COLLEGES, UNIVERSITIES, SCHOOLS	824.378	s15.174	0.82
509 OTHER EDUCATIONAL SERVICES	$8.434	$4.322	0.06
510 BUSINESS ASSOCIATIONS	$5.430	82.327	0.19
511 LABOR AND CIVIC ORGANIZATIONS	S25.216	$10.511	1.99
512 RELIGIOUS ORGANIZATIONS	$3.837	s2.222	0.13
513 OTHER NONPROFIT ORGANIZATIONS	$4.737	S2.289	0.17
514 RESIDENTIAL CARE	915.047	$6.705	0.78
515 SOCIAL SERVICES, N.E.C.	$63.793	952.333	1.99
516 U.S. POSTAL SERVICE	$63.257	S58.226	1.31
517 FEDERAL ELECTRIC UTILITIES	92.362	so.711	0.01
518 OTHER FEDERAL GOVERNMENT ENTERPR	S135.655	$82.177	1.90
519 LOCAL GOVERNMENT PASSENGER TRANS	SO.250	50.098	0.01
520 STATE AND LOCAL ELECTRIC UTILITI	$31.975	96.732	0.14
521 OTHER STATE AND LOCAL GOVT ENTER	8427.272	$165.761	6.40
525 GOVERNMENT INDUSTRY	8128.140	$95.146	3.82
526 REST OF THE WORLD INDUSTRY	$0.000	80.000	0.00
527 HOUSEHOLD INDUSTRY	811.892	811.892	1.14
528 INVENTORY VALUATION ADJUSTMENT	so. 000	$0.000	0.00
EMPLOYEE COMPENSATION	$7,404.437	$0.000	0.00
TOTAL	$17,627.154	$8,507.806	442.22

REGION CONSTRUCTION MODEL
OUT-OF-AREA CONTRACTOR
SECTOR SPECIFIC IMPACTS
1989 DOLLARS

IMPLAN SECTOR	INDUSTRY OUTPUT (M)	VALUE ADDED (M)	EMPLOYMENT
1 DAIRY FARM PRODUCTS	839.187	S8.753	10.93
2 POULTRY AND EGGS	823.058	S1.967	0.19
3 RANCH FED CATTLE	82.217	SO.203	0.02
4 RANGE FED CATTLE	810.361	so.947	0.08
5 CATTLE FEEDLOTS	9145.223	914.008	1.09
6 SHEEP, LAMBS AND GOATS	84.906	SO.448	0.04
7 HOGS, PIGS AND SWINE	S4.792	SO.438	0.04
8 OTHER MEAT ANIMAL PRODUCTS	so.479	80.044	0.00
9 MISCELLANEOUS LIVESTOCK	$4.164	SO.592	0.06
11 FOOD GRAINS	91.406	SO.478	0.03
12 FEED GRAINS	S30.138	89.958	0.23
13 HAY AND PASTURE	813.091	84.326	0.10
14 GRASS SEEDS	so.144	30.064	0.00
16 FRUITS	842.970	S21.821	1.50
17 TREE NUTS	82.104	31.284	0.08
18 VEGETABLES	963.083	S39.696	1.33
19 SUGAR CROPS	so. 000	80.000	0.00
20 MISCELLANEOUS CROPS	S3.178	St.412	0.03
22 FOREST PRODUCTS	so.686	so.505	0.01
23 GREENHOUSE AND NURSERY PRO	94.776	82.258	0.29
24 FORESTRY PRODUCTS	82.438	81.095	0.01
26 AGRICULTURAL, FORESTRY, FI	814.918	86.163	0.52
27 LANDSCAPE AND HORTICULTURA	814.637	$10.400	0.49
33 SILVER ORES	$0.000	so.000	0.00
45 CRUSHED AND BROKEN LIMESTO	91.994	81.086	0.02
47 CRUSHED AND BROKEN STONE,	8697.456	9377.775	6.30
48 CONSTRUCTION SAND AND GRAV	S492.495	8243.779	4.13
58 MISC. NONMETALLIC MINERALS	so.575	SO.271	0.01
66 NEW RESIDENTIAL STRUCTURES	8625.614	8195.032	7.78
67 NEW INDUSTRIAL AND COMMERC	$2,151.742	9934.083	23.16
68 NEW UTILITY STRUCTURES	$3,810.616	S611.113	6.25
69 NEU HIGHWAYS AND STREETS	$4,408.943	8462.955	4.92
70 NEU FARM STRUCTURES	30.000	80.000	0.00
72 NEW GOVERNMENT FACILITIES	$2,404.698	$900.300	19.04
73 MAINTENANCE AND REPAIR, RE	550.987	832.655	0.98
74 MAINTENANCE AND REPAIR OTH	$1,566.299	8450.338	12.45
75 MAINTENANCE AND REPAIR OIL	90.000	so. 000	0.00
79 SMALL ARMS	SO.038	SO.018	0.00
82 MEAT PACKING PLANTS	8359.387	535.636	0.85
87 CHEESE, NATURAL AND PROCES	S7.312	SO.697	0.03
90 FLUID MILK	$39.713	89.378	0.12
91 CANNED AND CURED SEA FOODS	$1.109	80.270	0.02
93 CANNED FRUITS AND VEGETABL	845.193	811.360	0.15

94 DEHYDRATED FOOD PRODUCTS	57.939	$2.073	0.06
95 PICKLES, SAUCES, AND SALAD	s4.588	so.966	0.02
97 FROZEN FRUITS, JUICES AND	837.122	87.358	0.24
103 PREPARED FEEDS, N.E.C	S8.942	81.467	0.02
106 BREAD, CAKE, AND RELATED P	821.265	89.687	0.63
112 MALT LIQUORS	S15.721	93.224	0.05
114 WINES, BRANDY, AND BRANDY	818.772	82.803	0.08
115 DISTILLED LIQUOR, EXCEPT B	817.388	St.556	0.03
116 BOTTLED AND CANNED SOFT DR	836.614	88.839	0.19
117 FLAVORING EXTRACTS AND SYR	s9.773	84.218	0.02
122 ROASTED COFFEE	S38.922	97.655	0.12
123 SHORTENING AND COOKING OIL	SO.338	80.040	0.00
125 MACARONI AND SPAGHETTI	S3.204	so.971	0.03
126 FOOD PREPARATIONS, N.E.C	879.012	829.731	0.32
131 BROADWOVEN FABRIC MILLS AN	SO.288	so.070	0.00
151 APPAREL MADE FROM PURCHASE	823.243	88.244	1.09
152 CURTAINS AND DRAPERIES	91.104	SO.326	0.02
155 CANVAS PRODUCTS	81.759	SO.653	0.04
156 PLEATING AND STITCHING	SO.219	80.074	0.01
160 LOGGING CAMPS AND LOGGING	977.032	922.699	0.20
161 SAWMILLS AND PLANING MILLS	$98.019	S33.627	1.06
162 HARDWOOD DIMENSION AND FL0	$2.335	so.559	0.02
163 SPECIAL PRODUCT SAWMILLS,	SO.214	80.098	0.00
164 MILLWORK	852.864	$13.062	0.61
165 WOOD KITCHEN CABINETS	53.775	81.419	0.05
166 VENEER AND PLYWOOD	$25.749	88.370	0.32
167 STRUCTURAL WOOD MEMBERS, N	89.337	52.633	0.15
168 PREFABRICATED WOOD BUILDIN	SO.158	80.039	0.00
169 UOOD PRESERVING	860.094	S13.529	0.60
170 WOOD PALLETS AND SKIDS	82.103	so.741	0.03
172 WOOD PRODUCTS, N.E.C	920.020	86.256	0.28
173 WOOD CONTAINERS	SO.192	80.068	0.00
174 WOOD HOUSEHOLD FURNITURE	S12.688	95.119	0.27
177 UPHOLSTERED HOUSEHOLD FURN	814.292	$5.525	0.36
179 MATTRESSES AND BEDSPRINGS	89.001	S2.563	0.07
183 WOOD PARTITIONS AND FIXTUR	SO.138	80.054	0.00
194 BAGS, EXCEPT TEXTILE	$2.801	SO.740	0.02
199 PAPERBOARD CONTAINERS AND	s34.919	89.735	0.21
200 NEWSPAPERS	8122.386	854.197	1.59
201 PERIODICALS	83.004	SO.806	0.03
204 MISCELLANEOUS PUBLISHING	82.078	$1.210	0.04
205 COMMERCIAL PRINTING	927.429	$12.055	0.39
210 ENGRAVING AND PLATE PRINT1	so.115	SO.065	0.00
213 PHOTOENGRAVING	so. 002	80.001	0.00
215 INDUSTRIAL INORGANIC, ORGA	$159.734	847.936	4.62
216 NITROGENOUS AND PHOSPHATIC	S5.236	81.518	0.04
218 AGRICULTURAL CHEMICALS, N.	84.992	El.548	0.01
224 CHEMICAL PREPARATIONS, N.E	$3.476	31.045	0.02
225 PLASTICS MATERIALS AND RES	so.200	SO.057	0.00
229 DRUGS	s1.119	so.505	0.01

231 POLISHES AND SANITATION GO	80.379	$0.109	0.00
232 SURFACE ACTIVE AGENTS	$4.443	$1.503	0.01
234 PAINTS AND ALLIED PRODUCTS	$2.164	$0.689	0.01
238 PAVING MIXTURES AND BLOCKS	$59.877	$17.615	0.12
243 FABRICATED RUBBER PRODUCTS	so. 000	$0.000	0.00
244 MISCELLANEOUS PLASTICS PRO	$4.649	$1.707	0.03
255 GLASS AND GLASS PRODUCTS,	$0.447	80.204	0.01
267 CONCRETE BLOCK AND BRICK	$414.868	3184.070	5.13
268 CONCRETE PRODUCTS, N.E.C	$2.832	$1.150	0.03
269 READY-MIXED CONCRETE	$1.897.752	8534.502	12.32
276 MINERALS, GROUND OR TREATE	$1.157	SD. 270	0.01
280 BLAST FURNACES AND STEEL M	$1.983	$0.674	0.01
285 IRON AND STEEL FOUNDRIES	30.000	80.000	0.00
292 PRIMARY ALUMINUM	$9.926	$2.504	0.03
294 SECONDARY NONFERROUS METAL	$4.140	80.812	0.02
297 NONFERROUS ROLLING AND DRA	333.569	$4.988	0.34
303 METAL CANS	80.973	30.298	0.01
306 PLUMBING FIXTURE FITTINGS	$0.831	$0.312	0.01
307 HEATING EQUIPMENT, EXCEPT	$3.574	$1.438	0.07
308 FABRICATED STRUCTURAL META	$2,555.990	$941.520	24.21
309 METAL DOORS, SASH, AND TRI	87.423	$2.561	0.09
310 FABRICATED PLATE WORK (BOI	$1.031	$0.428	0.01
311 SHEET METAL UORK	812.898	84.774	0.09
312 ARCHITECTURAL METAL WORK	$0.893	$0.434	0.01
313 PREFABRICATED METAL BUILD1	$5.081	$1.503	0.04
320 HAND AND EDGE TOOLS, N.E.C	$0.027	$0.013	0.00
322 HARDUARE, N.E.C.	$1.925	$0.917	0.07
323 PLATING AND POLISHING	$0.645	30.330	0.01
327 PIPE, VALVES, AND PIPE FIT	$23.127	$9.609	0.06
329 FABRICATED METAL PRODUCTS,	$3.192	81.204	0.04
332 FARM MACHINERY AND EQUIPME	$2.628	90.925	0.02
335 MINING MACHINERY, EXCEPT 0	$0.091	$0.032	0.00
340 INDUSTRIAL TRUCKS AND TRAC	$0.505	$0.177	0.00
343 SPECIAL DIES AND TOOLS AND	$0.088	$0.047	0.00
347 FOOD PRODUCTS MACHINERY	$2.621	81.141	0.03
350 PAPER INDUSTRIES MACHINERY	$1.252	$0.456	0.01
352 SPECIAL INDUSTRY MACHINERY	$3.314	$1.299	0.05
355 BLOWERS AND FANS	$0.267	30.101	0.00
361 MACHINERY, EXCEPT ELECTRIC	$159.781	$77.153	2.29
362 ELECTRONIC COMPUTING EQUIP	$0.054	$0.029	0.00
386 ELECTRIC LAMPS	80.112	$0.041	0.00
392 RADIO AND TV COMMUNICATION	$0.081	$0.042	0.00
395 ELECTRONIC COMPONENTS, N.E	$12.160	84.169	0.09
398 X-RAY APPARATUS AND TUBES	$1.857	SO.691	0.02
402 TRUCK TRAILERS	$0.729	80.184	0.01
404 MOTOR VEHICLE PARTS AND AC	$0.000	$0.000	0.00
405 AIRCRAFT	$0.004	$0.001	0.00
407 AIRCRAFT AND MISSILE EQUIP	$2.983	81.389	0.03
408 SHIP BUILDING AND REPAIRIN	$0.147	$0.076	0.00
409 BOAT BUILDING AND REPAIRIN	$2.485	$0.657	0.02

412 TRAVEL TRAILERS AND CAMPER	39.730	32.434	0.21
413 MOBILE HOMES	310.439	32.325	0.07
417 MECHANICAL MEASURING DEVIC	31.826	31.013	0.05
420 SURGICAL APPLIANCES AND SU	$0.488	SO.253	0.01
424 OPHTHALMIC GOODS	$8.081	$4.723	0.11
426 JEUELRY, PRECIOUS METAL	30.302	so.064	0.00
430 MUSICAL INSTRUMENTS	30.235	30.108	0.00
432 DOLLS	30.000	so. 000	0.00
433 SPORTING AND ATHLETIC GOOD	$9.180	$4.067	0.12
436 MARKING DEVICES	SD.096	SO.039	0.00
444 SIGNS	312.976	86.182	0.16
445 MANUFACTURING INDUSTRIES,	SD.263	$0.108	0.01
446 RAILROADS AND RELATED SERV	$31.733	315.965	0.33
447 LOCAL, INTERURBAN PASSENGE	331.290	320.245	0.55
448 MOTOR FREIGHT TRANSPORT AN	3513.653	8292.333	7.98
449 WATER TRANSPORTATION	$41.183	$9.059	0.21
450 AIR TRANSPORTATION	$210.849	860.708	0.71
451 PIPE LINES, EXCEPT NATURAL	320.066	$11.151	0.03
452 TRANSPORTATION SERVICES	325.705	311.257	0.58
453 ARRANGEMENT OF PASSENGER T	3671.736	3362.236	17.09
454 COMMUNICATIONS, EXCEPT RAD	$475.168	3383.937	5.18
455 RADIO AND TV BROADCASTING	$167.713	376.786	1.45
456 ELECTRIC SERVICES	3504.625	3228.213	1.98
457 GAS PRODUCTION AND DISTRIB	$112.703	321.589	0.25
458 UATER SUPPLY AND SEUERAGE	34.891	32.292	0.12
459 SANITARY SERVICES AND STEA	357.450	533.813	1.05
460 RECREATIONAL RELATED UHOLE	3111.795	860.616	0.49
461 OTHER UHOLESALE TRADE	8335.065	3181.673	87.95
462 RECREATIONAL RELATED RETAI	3289.999	3167.010	9.53
463 OTHER RETAIL TRADE	$2,276.220	$1,310.874	63.94
464 BANKING	$382.867	3216.272	6.04
465 CREDIT AGENCIES	378.959	359.436	2.72
466 SECURITY AND COMMODITY BRO	343.052	831.189	0.44
467 INSURANCE CARRIERS	3136.036	$33.603	1.44
468 INSURANCE AGENTS AND BROKE	3385.543	3244.144	5.96
469 OUNER-OCCUPIED DWELLINGS	3278.561	$178.293	0.25
470 REAL ESTATE	$2,023.816	$1,370.772	69.71
471 HOTELS AND LODGING PLACES	$419.377	$182.842	15.08
472 LAUNDRY, CLEANING AND SHOE	352.032	328.229	1.61
473 FUNERAL SERVICE AND CREMAT	315.733	35.781	0.33
474 PORTRAIT AND PHOTOGRAPHIC	364.878	339.348	1.05
475 ELECTRICAL REPAIR SERVICES	336.821	323.378	0.39
476 WATCH, CLOCK, JEWELRY AND	$7.702	$5.586	0.09
477 BEAUTY AND BARBER SHOPS	374.592	$52.607	2.34
478 MISCELLANEOUS REPAIR SHOPS	375.316	$56.891	1.14
479 SERVICES TO BUILDINGS	338.978	$30.358	1.76
480 PERSONNEL SUPPLY SERVICES	379.014	$66.815	1.30
481 COMPUTER AND DATA PROCESS!	$214.039	$159.680	1.62
482 MANAGEMENT AND CONSULTING	$2,974.175	$1,947.065	57.75
483 DETECTIVE AND PROTECTIVE S	$19.822	315.059	0.75

484 EQUIPMENT REPAIR AND LEAS!	3204.212	3147.279	0.97
485 PHOTOFINISHING, COMMERCIAL	371.549	345.593	0.90
486 OTHER BUSINESS SERVICES	$62.061	339.157	2.13
487 ADVERTISING	39.506	86.634	0.18
488 LEGAL SERVICES	3206.902	$131.468	2.31
489 ENGINEERING, ARCHITECTURAL	$2,469.102	$1,650.402	33.04
490 ACCOUNTING, AUDITING AND B	359.168	$43.978	1.11
491 EATING AND DRINKING PLACES	$1,148.784	3420.253	32.91
492 AUTOMOBILE RENTAL AND LEAS	3228.115	3110.198	3.15
493 AUTOMOBILE REPAIR AND SERV	3778.781	3329.297	6.74
494 AUTOMOBILE PARKING AND CAR	312.051	$6.755	0.30
495 MOTION PICTURES	311.665	$4.504	0.50
496 DANCE HALLS, STUDIOS AND S	31.732	so.959	0.12
497 THEATRICAL PRODUCERS, BAND	$4.950	32.485	0.10
498 BOWLING ALLEYS AND POOL HA	320.772	39.595	0.95
499 COMMERCIAL SPORTS EXCEPT R	32.575	31.388	0.13
500 RACING AND TRACK OPERATION	314.421	35.907	0.14
501 MEMBERSHIP SPORTS AND RECR	317.279	35.544	1.03
502 AMUSEMENT AND RECREATION S	379.989	344.271	2.65
503 DOCTORS AND DENTISTS	3996.204	3601.437	10.42
504 HOSPITALS	3581.460	3294.960	14.85
505 NURSING AND PROTECTIVE CAR	3120.113	366.324	3.97
506 OTHER MEDICAL AND HEALTH S	3230.279	3115.780	3.64
507 ELEMENTARY AND SECONDARY S	366.797	330.813	5.18
508 COLLEGES, UNIVERSITIES, SC	$69.239	$43.099	2.33
509 OTHER EDUCATIONAL SERVICES	322.936	311.753	0.17
510 BUSINESS ASSOCIATIONS	312.511	35.361	0.43
511 LABOR AND CIVIC ORGANIZATI	$68.746	328.656	5.44
512 RELILIOUS ORGANIZATIONS	310.485	$6.071	0.36
513 OTHER NONPROFIT ORGANIZATI	313.282	$6.420	0.48
514 RESIDENTIAL CARE	340.991	318.267	2.13
515 SOCIAL SERVICES, N.E.C.	3167.233	3137.192	5.22
516 U.S. POSTAL SERVICE	3132.708	3122.153	2.74
517 FEDERAL ELECTRIC UTILITIES	33.982	$1.199	0.01
518 OTHER FEDERAL GOVERNMENT E	3817.069	3494.963	11.47
519 LOCAL GOVERNMENT PASSENGER	30.625	SO.245	0.03
520 STATE AND LOCAL ELECTRIC U	3160.170	333.721	0.72
521 OTHER STATE AND LOCAL GOVT	3597.198	3231.685	8.95
525 GOVERNMENT INDUSTRY	3460.025	3341.577	13.73
526 REST OF THE VORLD INDUSTRY	30.000	30.000	0.00
527 HOUSEHOLD INDUSTRY	332.432	332.432	3.12
528 INVENTORY VALUATION ADJUST	30.000	30.000	0.00
VALUE ADDED	$20,184.980		
TOTAL IMPACT	$43,765.673	$20,184.282	719.33

REGION CONSTRUCTION MODEL
LOCAL CONTRACTOR
1989 DOLLARS
SECTOR SPECIFIC IMPACTS

IMPLAN SECTOR	INDUSTRY OUTPUT (M)	VALUE ADDED (M)	EMPLOYMENT
1 DAIRY FARM PRODUCTS	354.325	312.134	15.16
2 POULTRY AND EGGS	331.579	32.694	0.26
3 RANCH FED CATTLE	33.040	SO.278	0.02
4 RANGE FED CATTLE	314.129	31.291	0.10
5 CATTLE FEEDLOTS	3197.815	319.081	1.49
6 SHEEP, LAMBS AND GOATS	$6.665	30.609	0.05
7 HOGS, PIGS AND SWINE	86.550	SO.598	0.05
8 OTHER MEAT ANIMAL PRODUCTS	SO.677	SO.062	0.01
9 MISCELLANEOUS LIVESTOCK	35.516	SO.784	0.08
11 FOOD GRAINS	31.978	SO.672	0.04
12 FEED GRAINS	340.823	313.489	0.31
13 HAY AND PASTURE	318.042	35.962	0.14
14 GRASS SEEDS	30.186	30.082	0.00
16 FRUITS	359.176	330.051	2.07
17 TREE NUTS	32.927	31.785	0.11
18 VEGETABLES	386.332	354.326	1.81
19 SUGAR CROPS	30.000	30.000	0.00
20 MISCELLANEOUS CROPS	34.329	31.923	0.05
22 FOREST PRODUCTS	31.096	30.807	0.02
23 GREENHOUSE AND NURSERY PRO	36.584	33.113	0.40
24 FORESTRY PRODUCTS	33.849	31.729	0.02
26 AGRICULTURAL, FORESTRY, FI	320.423	38.437	0.71
27 LANDSCAPE AND HORTICULTURA	319.217	313.655	0.64
33 SILVER ORES	30.000	so. 000	0.00
45 CRUSHED AND BROKEN LIMESTO	32.512	31.369	0.02
47 CRUSHED AND BROKEN STONE,	3718.204	3389.013	6.49
48 CONSTRUCTION SAND AND GRAV	3505.720	3250.325	4.24
58 MISC. NONMETALLIC MINERALS	SO.688	SO.325	0.01

REGION CONSTRUCTION MDDEL

66 NEU RESIDENTIAL STRUCTURES	$625.614	$195.032	7.78
67 NEW INDUSTRIAL AND CDMMERC	$5,379.356	$2,335.208	57.89
68 NEW UTILITY STRUCTURES	$8,746.752	$1,402.727	14.34
69 NEW HIGHWAYS AND STREETS	$1,408.943	3462.955	4.92
70 NEU FARM STRUCTURES	30.000	30.000	0.00
72 NEW GOVERNMENT FACILITIES	$6,011.745	$2,250.750	47.60
73 MAINTENANCE AND REPAIR, RE	861.535	339.411	1.19
74 MAINTENANCE AND REPAIR OTH	$1,574.662	3452.742	12.52
75 MAINTENANCE AND REPAIR OIL	so. 000	30.000	0.00
79 SMALL ARMS	30.038	80.018	0.00

82 MEAT PACKING PLANTS	3489.594	348.547	1.16
87 CHEESE, NATURAL AND PROCES	310.016	30.955	0.03
90 FLUID MILK	354.648	312.904	0.16
91 CANNED AND CURED SEA FOODS	31.515	SO.369	0.03
93 CANNED FRUITS AND VEGETABL	$62.101	315.610	0.20
94 DEHYDRATED FOOD PRODUCTS	310.921	32.852	0.08
95 PICKLES, SAUCES, AND SALAD	$6.272	31.320	0.03
97 FROZEN FRUITS, JUICES AND	350.070	39.925	0.32
103 PREPARED FEEDS, N.E.C	$12.006	31.969	0.03
106 BREAD, CAKE, AND RELATED P	328.931	313.179	0.85
112 MALT LIQUORS	321.335	$4.376	0.07
114 WINES, BRANDY, AND BRANDY	325.215	33.765	0.11
115 DISTILLED LIQUOR, EXCEPT B	323.623	32.114	0.04
116 BOTTLED AND CANNED SOFT DR	350.097	312.093	0.25
117 FLAVORING EXTRACTS AND SYR	313.216	85.703	0.03
122 ROASTED COFFEE	353.131	310.450	0.16
123 SHORTENING AND COOKING OIL	SO.467	30.055	0.00
125 MACARONI AND SPAGHETTI	34.428	31.342	0.03
126 FOOD PREPARATIONS, N.E.C	3108.400	$40.790	0.43
131 BROADUOVEN FABRIC MILLS AN	30.412	so. 100	0.00
151 APPAREL MADE FROM PURCHASE	332.269	$11.445	1.52
152 CURTAINS AND DRAPERIES	31.509	SO.446	0.03
155 CANVAS PRODUCTS	33.016	31.119	0.08
156 PLEATING AND STITCHING	SO.293	30.099	0.01
160 LOGGING CAMPS AND LOGGING	3123.402	336.363	0.32

REGION CONSTRUCTION MODEL

161 SAWMILLS AND PLANING MILLS	3150.853	351.752	1.63
162 HARDWOOD DIMENSION AND FL0	33.136	30.750	0.03
163 SPECIAL PRODUCT SAWMILLS,	30.343	30.157	0.01
164 MILLWORK	383.935	320.739	0.97
165 WOOD KITCHEN CABINETS	84.517	31.698	0.06
166 VENEER AND PLYUOOD	335.999	$11.702	0.45
167 STRUCTURAL UOOD MEMBERS, N	319.470	35.490	0.31
168 PREFABRICATED MOOD BUILDIN	30.340	30.083	0.01
169 UOOD PRESERVING	3131.450	329.592	1.32
170 WOOD PALLETS AND SKIDS	33.017	31.064	0.04
172 UOOD PRODUCTS, N.E.C	333.779	310.556	0.48
173 WOOD CONTAINERS	30.310	30.110	0.00
174 UOOD HOUSEHOLD FURNITURE	$17.632	37.113	0.38
177 UPHOLSTERED HOUSEHOLD FURN	319.844	37.671	0.50
179 MATTRESSES AND BEDSPRINGS	$12.502	33.561	0.10
183 UOOD PARTITIONS AND FIXTUR	80.303	30.119	0.01
194 BAGS, EXCEPT TEXTILE	83.750	so.991	0.02
199 PAPERBOARD CONTAINERS AND	346.122	312.858	0.28
200 NEWSPAPERS	8158.358	370.127	2.06
201 PERIODICALS	34.052	31.087	0.04
204 MISCELLANEOUS PUBLISHING	32.604	31.516	0.05
205 COMMERCIAL PRINTING	335.674	315.678	0.50
210 ENGRAVING AND PLATE PRINT1	30.121	30.068	0.00
213 PHOTOENGRAVING	SD.002	30.001	0.00
215 INDUSTRIAL INORGANIC, ORGA	3213.300	$64.011	6.17

216 NITROGENOUS AND PHOSPHATIC	$6.962	32.018	0.05
218 AGRICULTURAL CHEMICALS, N.	$6.421	31.991	0.02
224 CHEMICAL PREPARATIONS, N.E	$4.296	31.291	0.02
225 PLASTICS MATERIALS AND RES	30.274	30.079	0.00
229 DRUGS	31.525	SO.688	0.01
231 POLISHES AND SANITATION GO	30.508	30.146	0.00
232 SURFACE ACTIVE AGENTS	35.170	31.749	0.02
234 PAINTS AND ALLIED PRODUCTS	32.741	30.873	0.02
238 PAVING MIXTURES AND BLOCKS	390.274	326.557	0.19
243 FABRICATED RUBBER PRODUCTS	SD.000	30.000	0.00

REGION CONSTRUCTION MODEL

244 MISCELLANEOUS PLASTICS PRO	86.668	32.449	0.05
255 GLASS AND GLASS PROOUCTS,	30.635	30.289	0.01
267 CONCRETE BLOCK AND BRICK	$414.868	3184.070	5.13
268 CONCRETE PRODUCTS, N.E.C	35.165	32.098	0.05
269 READY-MIXED CONCRETE	$1,928.576	3543.183	12.52
276 MINERALS, GROUND OR TREATE	$1.408	30.329	0.01
280 BLAST FURNACES AND STEEL M	32.363	30.803	0.02
285 IRON AND STEEL FOUNDRIES	30.000	30.000	0.00
292 PRIMARY ALUMINUM	312.323	33.109	0.04
294 SECONDARY NONFERROUS METAL	86.629	31.301	0.03
297 NONFERROUS ROLLING AND DRA	371.313	310.596	0.72
303 METAL CANS	31.310	30.401	0.01
306 PLUMBING FIXTURE FITTINGS	31.372	30.515	0.02
307 HEATING EQUIPMENT, EXCEPT	$6.431	32.588	0.13
308 FABRICATED STRUCTURAL META	$2,566.946	3945.556	24.32
309 METAL DOORS, SASH, AND TRI	312.781	$4.410	0.15
310 FABRICATED PLATE WORK (BOI	32.189	30.909	0.01
311 SHEET METAL WORK	323.006	$8.516	0.17
312 ARCHITECTURAL METAL WORK	31.784	SO.866	0.03
313 PREFABRICATED METAL BUILD1	311.880	33.515	0.10
320 HAND AND EDGE TOOLS, N.E.C	30.027	30.013	0.00
322 HARDWARE, N.E.C.	33.134	31.494	0.11
323 PLATING AND POLISHING	30.645	30.330	0.01
327 PIPE, VALVES, AND PIPE FIT	$46.145	319.172	0.13
329 FABRICATED METAL PRODUCTS,	$5.091	31.920	0.07
332 FARM MACHINERY AND EPUIPME	33.598	31.267	0.03
335 MINING MACHINERY, EXCEPT 0	30.091	30.032	0.00
340 INDUSTRIAL TRUCKS AND TRAC	30.657	30.230	0.00
343 SPECIAL DIES AND TOOLS AND	to.088	30.047	0.00
347 FOOD PRODUCTS MACHINERY	33.908	31.701	0.04
350 PAPER INDUSTRIES MACHINERY	32.037	30.741	0.02
352 SPECIAL INDUSTRY MACHINERY	$4.906	31.923	0.08
355 BLOWERS AND FANS	30.515	30.196	0.01
361 MACHINERY, EXCEPT ELECTRIC	3160.153	377.332	2.30
362 ELECTRONIC COMPUTING EQUIP	30.054	30.029	0.00

386 ELECTRIC LAMPS	30.150	30.055	0.00
392 RADIO AND TV COMMUNICATION	30.150	SO. 077	0.00
395 ELECTRONIC COMPONENTS, N.E	315.085	$5.172	0.11
398 X-RAY APPARATUS AND TUBES	32.583	30.961	0.03
402 TRUCK TRAILERS	31.407	SO.356	0.01
404 MOTOR VEHICLE PARTS AND AC	so. 000	30.000	0.00
405 AIRCRAFT	to. 004	30.001	0.00
407 AIRCRAFT AND MISSILE EQUIP	33.896	31.814	0.04
408 SHIP BUILDING AND REPAIRIN	SO. 265	30.137	0.00
409 BOAT BUILDING AND REPAIRIN	33.470	30.917	0.03
412 TRAVEL TRAILERS AND CAMPER	313.662	33.418	0.29
413 MOBILE HOMES	310.439	32.325	0.07
417 MECHANICAL MEASURING DEVIC	$3.479	31.931	0.09
420 SURGICAL APPLIANCES AND SU	so.735	SO.381	0.01
424 OPHTHALMIC GOODS	311.144	36.514	0.15
426 JEWELRY, PRECIOUS METAL	SO.426	30.090	0.01
430 MUSICAL INSTRUMENTS	30.309	30.142	0.00
432 DOLLS	30.000	so. 000	0.00
433 SPORTING AND ATHLETIC GOOD	312.619	35.591	0.17
436 MARKING DEVICES	30.102	30.041	0.00
444 SIGNS	316.798	$8.002	0.20
445 MANUFACTURING INDUSTRIES,	30.386	SD. 159	0.01
446 RAILROADS AND RELATED SERV	340.795	320.524	0.43
447 LOCAL, INTERURBAN PASSENGE	343.474	328.128	0.76
448 MOTOR FREIGHT TRANSPORT AN	3719.493	3409.482	11.18
449 WATER TRANSPORTATION	357.216	312.586	0.29
450 AIR TRANSPORTATION	3256.218	373.771	0.87
451 PIPE LINES, EXCEPT NATURAL	328.603	315.896	0.04
452 TRANSPORTATION SERVICES	334.877	315.274	0.78
453 ARRANGEMENT OF PASSENGER T	3673.084	$362.963	17.13
454 COMMUNICATIONS, EXCEPT RAO	3656.119	3530.146	7.16
455 RADIO AND TV BROADCASTING	3213.512	397.754	1.85
456 ELECTRIC SERVICES	$670.857	3303.390	2.64
457 GAS PRODUCTION AND DISTRIB	3149.243	328.589	0.33
458 UATER SUPPLY AND SEWERAGE	86.581	$3.084	0.16

REGION CONSTRUCTION MODEL

459 SANITARY SERVICES AND STEA	373.869	343.477	1.34
460 RECREATIONAL RELATED WHOLE	3146.338	379.345	0.65
461 OTHER WHOLESALE TRADE	3377.737	$204.810	99.15
462 RECREATIONAL RELATED RETAI	3322.828	$185.916	10.61
463 OTHER RETAIL TRADE	$2,997.355	$1,726.175	84.19
464 BANKING	3529.266	3298.969	8.34
465 CREDIT AGENCIES	3106.492	380.161	3.67
466 SECURITY AND COMMODITY BRO	358.092	$42.086	0.60
467 INSURANCE CARRIERS	3192.182	347.472	2.04
468 INSURANCE AGENTS AND BROKE	3916.425	3580.325	14.17

469 OUNER-OCCUPIED DWELLINGS	8386.617	3247.455	0.34
470 REAL ESTATE	$2,249.930	$1,523.923	77.50
471 HOTELS AND LODGING PLACES	3507.599	3221.306	18.25
472 LAUNDRY, CLEANING AND SHOE	$71.098	338.573	2.20
473 FUNERAL SERVICE AND CREMAT	321.820	$8.018	0.46
474 PORTRAIT AND PHOTOGRAPHIC	389.452	354.252	1.45
475 ELECTRICAL REPAIR SERVICES	349.701	331.556	0.53
476 UATCH, CLOCK, JEWELRY AND	$10.684	37.748	0.13
477 BEAUTY AND BARBER SHOPS	3103.527	373.014	3.24
478 MISCELLANEWS REPAIR SHOPS	3115.074	$86.923	1.74
479 SERVICES TO BUILDINGS	348.988	338.154	2.22
480 PERSONNEL SUPPLY SERVICES	393.896	379.400	1.54
481 COMPUTER AND DATA PROCESS1	3292.250	3218.028	2.21
482 MANAGEMENT AND CONSULTING	$3,012.478	$1,972.140	58.49
483 DETECTIVE AND PROTECTIVE S	324.751	318.803	0.93
484 EQUIPMENT REPAIR AND LEAS1	3295.136	3212.854	1.40
485 PHOTOFINISHING, COMMERCIAL	3101.571	$64.725	1.27
486 OTHER BUSINESS SERVICES	389.241	356.305	3.06
487 ADVERTISING	312.051	38.411	0.22
488 LEGAL SERVICES	3277.755	3176.489	3.11
489 ENGINEERING, ARCHITECTURAL	$4,009.195	$2,679.834	53.65
490 ACCWNTING, AUDITING AND B	380.668	359.958	1.52
491 EATING AND DRINKING PLACES	$1,510.546	3552.595	43.27
492 AUTOMOBILE RENTAL AND LEAS	3240.295	3116.082	3.32
493 AUTOMOBILE REPAIR AND SERV	3966.226	3408.555	8.36

REGION CONSTRUCTION MODEL

494 AUTOMOBILE PARKING AND CAR	317.326	39.713	0.43
495 MOTION PICTURES	315.175	35.860	0.65
496 DANCE HALLS, STUDIOS AND S	32.390	31.323	0.17
497 THEATRICAL PRODUCERS, BAND	$6.482	33.254	0.12
498 BOWLING ALLEYS AND POOL HA	328.827	313.315	1.32
499 COMMERCIAL SPORTS EXCEPT R	33.560	31.919	0.17
500 RACING AND TRACK OPERATION	319.977	38.183	0.19
501 MEMBERSHIP SPORTS AND RECR	323.919	37.674	1.42
502 AMUSEMENT AND RECREATION S	3111.010	361.439	3.67
503 DOCTORS AND DENTISTS	$1,382.749	3834.806	14.47
504 HOSPITALS	3807.057	3409.399	20.61
505 NURSING AND PROTECTIVE CAR	3166.701	392.048	5.51
506 OTHER MEDICAL AND HEALTH S	3319.576	3160.677	5.05
507 ELEMENTARY AND SECONDARY S	392.702	342.762	7.19
508 COLLEGES, UNIVERSITIES, SC	395.200	359.258	3.20
509 OTHER EDUCATIONAL SERVICES	331.878	316.335	0.23
510 BUSINESS ASSOCIATIONS	316.356	37.008	0.57
511 LABOR AND CIVIC ORGANIZAT!	395.400	339.767	7.54
512 RELIGIWS ORGANIZATIONS	314.574	38.438	0.51
513 OTHER NONPROFIT ORGANIZATI	318.281	38.836	0.66
514 RESIDENTIAL CARE	356.885	325.350	2.96
515 SOCIAL SERVICES, N.E.C.	3232.021	3190.342	7.24
516 U.S. POSTAL SERVICE	3186.375	3171.551	3.85
517 FEDERAL ELECTRIC UTILITIES	35.309	31.598	0.01
518 OTHER FEDERAL GOVERNMENT E	3895.622	3542.549	12.57

519 LOCAL GOVERNMENT PASSENGER	$0.882	80.346	0.04
520 STATE AND LOCAL ELECTRIC U	$173.602	836.549	0.78
521 OTHER STATE AND LOCAL GOVT	9818.171	$317.412	12.26
525 GOVERNMENT INDUSTRY	$460.025	3341.577	13.73
526 REST OF THE WORLD INDUSTRY	$0.000	80.000	0.00
527 HOUSEHOLD INDUSTRY	$45.018	845.018	4.33
528 INVENTORY VALUATION ADJUST	so. 000	$0.000	0.00
VALUE ADDED	$28,015.918		
TOTAL IMPACT	$63,387.554	$28,014.955	940.08

KIYAK CONSTRUCTION MODEL
OUT-OF-AREA CONTRACTOR
SECTOR SPECIFIC IMPACTS
1989 DOLLARS

	OUTPUT	VALUE ADDED	EMPLOYMENT
1 DAIRY FARM PRODUCTS	$34.187	$7.636	0.38
2 POULTRY AND EGGS	$19.935	91.700	0.17
3 RANCH FED CATTLE	91.499	$0.137	0.01
5 CATTLE FEEDLOTS	$99.702	$9.109	0.75
6 SHEEP, LAMBS AND GOATS	$3.779	so.345	0.03
7 HOGS, PIGS AND SWINE	so.949	SO.087	0.01
9 MISCELLANEOUS LIVESTOCK	53.974	SO.565	0.06
11 FOOD GRAINS	SO.369	SO.126	0.01
12 FEED GRAINS	sO.OOO	80.000	0.00
13 HAY AND PASTURE	$5.890	51.946	0.04
16 FRUITS	$29.604	915.083	1.05
18 VEGETABLES	$27.779	$17.480	0.58
20 MISCELLANEOUS CROPS	32.613	81.161	0.03
23 GREENHOUSE AND NURSERY PRODUCTS	$2.421	81.145	0.15
26 AGRICULTURAL, FORESTRY, FISHERY SERV	SO.836	so.345	0.02
27 LANDSCAPE AND HORTICULTURAL SERVICES	82.544	$1.808	0.10
45 CRUSHED AND BROKEN LIMESTONE	32.295	$1.251	0.02
48 CONSTRUCTION SAND AND GRAVEL	8898.827	$444.933	7.46
66 NEW RESIDENTIAL STRUCTURES	$448.624	$138.570	5.26
67 NEW INDUSTRIAL AND COMMERCIAL BUILD1	$1,833.899	8812.297	20.22
68 NEW UTILITY STRUCTURES	$2,841.811	$196.210	2.07
69 NEU HIGHUAYS AND STREETS	$733.643	$227.276	3.12
70 NEW FARM STRUCTURES	sO.OOO	$0.000	0.00
72 NEW GOVERNMENT FACILITIES	$1,672.281	$625.579	13.23
73 MAINTENANCE AND REPAIR, RESIDENTIAL	$40.950	$31.357	0.95
74 MAINTENANCE AND REPAIR OTHER FACILIT	$1,579.123	8411.250	7.62
75 MAINTENANCE AND REPAIR OIL AND GAS W	$0.000	$0.000	0.00
79 SMALL ARMS	80.097	SO.046	0.00
82 MEAT PACKING PLANTS	$274.133	$27.183	0.65
87 CHEESE, NATURAL AND PROCESSED	$11.134	$1.061	0.04
90 FLUID MILK	$60.043	814.178	0.18
91 CANNED AND CURED SEA FOODS	so.915	SO.223	0.02
93 CANNED FRUITS AND VEGETABLES	$38.239	89.612	0.11
94 DEHYDRATED FOOD PRODUCTS	$7.529	$1.966	0.06
95 PICKLES, SAUCES, AND SALAD DRESSINGS	81.103	SO.232	0.00
97 FROZEN FRUITS, JUICES AND VEGETABLES	$6.717	$1.348	0.04
103 PREPARED FEEDS, N.E.C	84.116	SO.675	0.01
106 BREAD, CAKE, AND RELATED PRODUCTS	830.728	$13.997	0.92
112 MALT LIQUORS	$11.849	$2.430	0.04
114 WINES, BRANDY, AND BRANDY SPIRITS	$11.589	$1.730	0.05
116 BOTTLED AND CANNED SOFT DRINKS	$29.615	$7.149	0.15
117 FLAVORING EXTRACTS AND SYRUPS, N.E.C	$5.314	82.293	0.01
122 ROASTED COFFEE	$31.615	$6.218	0.10
123 SHORTENING AND COOKING OILS	$0.036	80.004	0.00
126 FOOD PREPARATIONS, N.E.C	$70.523	$26.537	0.28
151 APPAREL MADE FROM PURCHASED MATERIAL	so.531	so.188	0.04

152	CURTAINS AND DRAPERIES	90.082	50.024	0.00
155	CANVAS PRODUCTS	$2.296	SO.852	0.06
160	LOGGING CAMPS AND LOGGING CONTRACTOR	952.416	$15.446	0.11
161	SAWMILLS AND PLANING MILLS, GENERAL	$72.696	524.939	0.90
162	HARDWOOD DIMENSION AND FLOORING MILL	$1.785	to.000	0.00
163	SPECIAL PRODUCT SAWMILLS, N.E.C	so.351	SO.161	0.01
164	MI LLUORK	S47.527	311.743	0.55
166	VENEER AND PLYWOOD	919.939	$6.482	0.23
167	STRUCTURAL WOOD MEMBERS, N.E.C	$7.600	92.143	0.13
168	PREFABRICATED WOOD BUILDINGS	SO.232	50.057	0.00
170	WOOD PALLETS AND SKIDS	32.382	90.840	0.03
172	WOOD PRODUCTS, N.E.C	$3.877	$1.211	0.05
173	WOOD CONTAINERS	so.414	SO.146	0.00
174	UOOD HOUSEHOLD FURNITURE	518.446	$7.442	0.40
177	UPHOLSTERED HOUSEHOLD FURNITURE	$17.427	$6.737	0.44
179	MATTRESSES AND BEDSPRINGS	$9.349	32.663	0.08
194	BAGS, EXCEPT TEXTILE	$4.008	$1.059	0.02
199	PAPERBOARD CONTAINERS AND BOXES	$32.188	$8.974	0.19
200	NEWSPAPERS	$73.921	832.735	0.98
201	PERIODICALS	$4.102	sl.IOO	0.04
204	MISCELLANEOUS PUBLISHING	so.649	80.347	0.01
205	COMMERCIAL PRINTING	$22.919	$10.072	0.32
210	ENGRAVING AND PLATE PRINTING	SO.231	SO.131	0.00
213	PHOTOENGRAVING	SO.009	SO.005	0.00
215	INDUSTRIAL INORGANIC, ORGANIC CHEMIC	SO.677	SO.203	0.02
218	AGRICULTURAL CHEMICALS, N.E.C	86.282	$1.948	0.02
224	CHEMICAL PREPARATIONS, N.E.C	$6.196	$1.863	0.03
231	POLISHES AND SANITATION GOODS	SO.727	SO.209	0.01
238	PAVING MIXTURES AND BLOCKS	576.545	$22.519	0.16
243	FABRICATED RUBBER PRODUCTS, N.E.C	SO.002	sO.OO1	0.00
244	MISCELLANEOUS PLASTICS PRODUCTS	$9.547	83.505	0.07
255	GLASS AND GLASS PRODUCTS, EXC CONTAI	$2.179	so.993	0.04
268	CONCRETE PRODUCTS, N.E.C	$294.637	8119.680	2.95
269	READY-MIXED CONCRETE	$1,452.205	$409.013	9.72
285	IRON AND STEEL FOUNDRIES	80.032	SO.016	0.00
303	METAL CANS	81.072	SO.328	0.01
307	HEATING EQUIPMENT, EXCEPT ELECTRIC	$4.718	91.899	0.09
308	FABRICATED STRUCTURAL METAL	$2,542.408	$936.523	24.68
309	METAL DDORS, SASH, AND TRIM	910.250	53.536	0.12
311	SHEET METAL WORK	$14.215	$5.262	0.10
313	PREFABRICATED METAL BUILDINGS	$6.147	31.819	0.05
320	HAND AND EDGE TOOLS, N.E.C.	$1.607	so.755	0.03
323	PLATING AND POLISHING	SO.927	so.474	0.01
327	PIPE, VALVES, AND PIPE FITTINGS	$27.666	$11.494	0.08
329	FABRICATED METAL PRODUCTS, N.E.C.	$2.170	SO.818	0.03
332	FARM MACHINERY AND EQUIPMENT	86.744	$2.375	0.05
335	MINING MACHINERY, EXCEPT OIL FIELD	$0.114	$0.040	0.00
343	SPECIAL DIES AND TOOLS AND ACCESSORI	80.391	so.211	0.02
347	FOOD PRODUCTS MACHINERY	82.035	so.886	0.02
350	PAPER INDUSTRIES MACHINERY	$1.905	SO.693	0.02
352	SPECIAL INDUSTRY MACHINERY, N.E.C.	53.309	51.297	0.05
355	BLOWERS AND FANS	so.731	SO.278	0.01
361	MACHINERY, EXCEPT ELECTRICAL, N.E.C.	$138.524	$66.889	1.96

413	MOBILE HOMES	$2.747	$0.612	0.02
417	MECHANICAL MEASURING DEVICES	SO.266	$0.147	0.01
420	SURGICAL APPLIANCES AND SUPPLIES	$0.154	$0.080	0.00
424	OPHTHALMIC GOODS	$2.907	31.699	0.04
426	JEWELRY, PRECIOUS METAL	80.096	$0.020	0.00
430	MUSICAL INSTRUMENTS	SO.091	$0.042	0.00
432	DOLLS	30.000	30.000	0.00
433	SPORTING AND ATHLETIC GOODS, N.E	$382.600	$169.497	5.20
436	MARKING DEVICES	$0.052	$0.021	0.00
444	SIGNS	$7.980	83.801	0.10
445	MANUFACTURING INDUSTRIES, N.E.C.	$0.094	80.039	0.00
446	RAILROADS AND RELATED SERVICES	$7.710	$3.879	0.08
447	LOCAL, INTERURBAN PASSENGER TRAN	812.454	$8.058	0.22
448	MOTOR FREIGHT TRANSPORT AND WARE	8121.413	$69.099	1.89
449	WATER TRANSPORTATION	$8.417	81.852	0.04
450	AIR TRANSPORTATION	$62.568	$18.015	0.21
451	PIPE LINES, EXCEPT NATURAL GAS	$6.581	$3.657	0.01
452	TRANSPORTATION SERVICES	87.614	83.334	0.17
453	ARRANGEMENT OF PASSENGER TRANSPO	$102.218	$55.122	2.60
454	COMMUNICATIONS, EXCEPT RADIO AND	3199.701	8161.359	2.18
455	RADIO AND TV BROADCASTING	8114.798	$52.559	0.99
456	ELECTRIC SERVICES	8304.269	$137.604	1.20
457	GAS PRODUCTION AND DISTRIBUTION	$55.809	810.691	0.12
458	WATER SUPPLY AND SEWERAGE SYSTEM	82.356	$1.104	0.06
459	SANITARY SERVICES AND STEAM SUPP	827.990	816.474	0.51
460	RECREATIONAL RELATED WHOLESALE T	3646.777	$350.683	2.85
461	OTHER WHOLESALE TRADE	$150.099	381.384	39.40
462	RECREATIONAL RELATED RETAIL TRAD	$3,948.846	$2,274.137	129.77
463	OTHER RETAIL TRADE	8615.765	9354.619	17.30
464	BANKING	8143.375	880.989	2.26
465	CREDIT AGENCIES	846.232	834.801	1.59
466	SECURITY AND COMMODITY BROKERS	816.545	$11.986	0.17
467	INSURANCE CARRIERS	$54.974	$13.579	0.58
468	INSURANCE AGENTS AND BROKERS	817.171	810.873	0.27
469	OWNER-OCCUPIED DWELLINGS	$102.189	865.406	0.09
470	REAL ESTATE	8345.471	8233.995	11.90
471	HOTELS AND LODGING PLACES	$2,012.432	$877.390	72.36
472	LAUNDRY, CLEANING AND SHOE REPAI	841.744	$22.647	1.29
473	FUNERAL SERVICE AND CREMATORIES	$5.785	$2.126	0.12
474	PORTRAIT AND PHOTOGRAPHIC STUDIO	823.485	814.244	0.38
475	ELECTRICAL REPAIR SERVICES	$14.085	$8.943	0.15
476	WATCH, CLOCK, JEWELRY AND FURNIT	$2.822	$2.046	0.03
477	BEAUTY AND BARBER SHOPS	827.362	$19.298	0.86
478	MISCELLANEWS REPAIR SHOPS	$21.572	$16.295	0.33
479	SERVICES TO BUILDINGS	828.131	$21.910	1.27
480	PERSONNEL SUPPLY SERVICES	324.964	$21.109	0.41
481	COMPUTER AND DATA PROCESSING SER	$67.521	950.373	0.51
482	MANAGEMENT AND CONSULTING SERVIC	$412.070	8269.765	8.00
483	DETECTIVE AND PROTECTIVE SERVICE	$11.633	38.838	0.44
484	EQUIPMENT REPAIR AND LEASING	$98.615	871.122	0.47

483	DETECTIVE AND PROTECTIVE SERVICES	$3.545	$2.693	0.17
484	EQUIPMENT REPAIR AND LEASING	$170.803	$123.184	1.13
485	PHOTOFINISHING, COMMERCIAL PHOTOGRAP	$33.282	$21.209	0.33
486	OTHER BUSINESS SERVICES	$41.131	825.951	1.46
487	ADVERTISING	34.990	$3.483	0.08
488	LEGAL SERVICES	$216.476	$137.551	2.19
489	ENGINEERING, ARCHITECTURAL SERVICES	$1,476.393	$986. a74	17.67
490	ACCOUNTING, AUDITING AND BOOKKEEPING	$60.338	$44.847	1.10
491	EATING AND DRINKING PLACES	$732.607	$268.006	20.63
492	AUTOMOBILE RENTAL AND LEASING	$201.699	$97.437	2.33
493	AUTOMOBILE REPAIR AND SERVICES	$477.897	$202.072	3.72
494	AUTOMOBILE PARKING AND CAR UASH	86.031	$3.381	0.14
495	MOTION PICTURES	$8.179	$3.172	0.33
496	DANCE HALLS, STUDIOS AND SCHOOLS	30.660	SO.365	0.05
497	THEATRICAL PRODUCERS, BANDS ETC.	83.502	$1.758	0.08
498	BOULING ALLEYS AND POOL HALLS	$9.334	$4.312	0.44
500	RACING AND TRACK OPERATION	$7.019	$2 .a75	0.07
501	MEMBERSHIP SPORTS AND RECREATION CLU	$9.249	$2.967	0.64
502	AMUSEMENT AND RECREATION SERVICES, N	$43.172	$23.894	1.32
503	DOCTORS AND DENTISTS	$526.406	$317.807	5.23
504	HOSPITALS	$330.195	$167.499	8.56
505	NURSING AND PROTECTIVE CARE	$66.756	$36.861	2.15
506	OTHER MEDICAL AND HEALTH SERVICES	$120.291	$60.480	1.86
507	ELEMENTARY AND SECONDARY SCHOOLS	$39.751	$18.337	3.21
508	COLLEGES, UNIVERSITIES, SCHOOLS	$34.816	$21.672	1.09
509	OTHER EDUCATIONAL SERVICES	$12.042	$6.175	0.08
510	BUSINESS ASSOCIATIONS	$15.583	$6.677	0.49
511	LABOR AND CIVIC ORGANIZATIONS	$29.901	$12.464	2.55
512	RELIGIOUS ORGANIZATIONS	$2.234	$1.293	0.08
513	OTHER NONPROFIT ORGANIZATIONS	$8.710	$4.210	0.41
514	RESIDENTIAL CARE	821.052	89.382	1.03
515	SOCIAL SERVICES, N.E.C.	391.307	$74.905	2.81
516	U.S. POSTAL SERVICE	374.421	869.961	1.49
517	FEDERAL ELECTRIC UTILITIES	$14.855	$4.472	0.04
518	OTHER FEDERAL GOVERNMENT ENTERPRISES	$1‘159.334	$702.301	16.29
520	STATE AND LOCAL ELECTRIC UTILITIES	$131.119	$27.605	0.60
521	OTHER STATE AND LOCAL GOVT ENTERPRIS	8525.798	3203.985	8.31
527	HWSEHOLD INDUSTRY	$23.336	$23.336	2.25
	VALUE ADDED	$14,393.107	to. 000	0.00
	32669.1056	$32,669.106	$14,393.050	544.66

RIVER HARVEST MODEL
SECTOR SPECIFIC IMPACTS
1989 DOLLARS

IMPLAN SECTOR	OUTPUT (M)	VALUE ADDED (M)	EMPLOYMENT
1 DAIRY FARM PRODUCTS	$2.529	so.153	0.03
2 POULTRY AND EGGS	92.023	so.113	0.02
3 RANCH FED CATTLE	30.000	30.000	0.00
4 RANGE FED CATTLE	30.108	30.006	0.00
5 CATTLE FEEDLOTS	SO.227	$0.048	0.00
6 SHEEP, LAMBS AND GOATS	so. 000	30.000	0.00
7 HOGS, PIGS AND SWINE	30.000	30.000	0.00
8 OTHER MEAT ANIMAL PRODUCTS	30.005	30.000	0.00
9 MISCELLANEOUS LIVESTOCK	30.661	80.060	0.01
11 FOOD GRAINS	30.139	so.007	0.00
12 FEED GRAINS	SO.742	30.025	0.01
13 HAY AND PASTURE	30.581	30.020	0.00
14 GRASS SEEDS	30.030	30.001	0.00
16 FRUITS	33.703	SO.778	0.12
17 TREE NUTS	30.206	30.044	0.01
18 VEGETABLES	86.727	30.901	0.14
19 SUGAR CROPS	30.000	30.000	0.00
20 MISCELLANEOUS CROPS	30.025	so.002	0.00
22 FOREST PRODUCTS	30.008	30.001	0.00
23 GREENHWSE AND NURSERY PRODUCTS	SO.956	so.337	0.06
24 FORESTRY PRODUCTS	SO.326	80.023	0.00
26 AGRICULTURAL, FORESTRY, FISHERY SERV	32.057	SO.648	0.08
27 LANDSCAPE AND HORTICULTURAL SERVICES	33.429	31.620	0.09
33 SILVER ORES	30.000	30.000	0.00
47 CRUSHED AND BROKEN STONE, N. E. C.	SO.242	30.075	0.00
48 CONSTRUCTION SAND AND GRAVEL	SO.070	80.023	0.00
66 NEW RESIDENTIAL STRUCTURES	30.000	30.000	0.00
67 NEW INDUSTRIAL AND COMMERCIAL BUILD1	30.000	30.000	0.00
68 NEW UTILITY STRUCTURES	338.791	813.694	0.16
69 NEW HIGHWAYS AND STREETS	30.000	30.000	0.00
70 NEW FARM STRUCTURES	30.000	80.000	0.00
72 NEW GOVERNMENT FACILITIES	so. 000	30.000	0.00
73 MAINTENANCE AND REPAIR, RESIDENTIAL	310.424	$3.499	0.11
74 MAINTENANCE AND REPAIR OTHER FACILIT	3276.913	3130.095	9.01
93 CANNED FRUITS AND VEGETABLES	$2.247	so.357	0.01
95 PICKLES, SAUCES, AND SALAD DRESSINGS	84.608	30.513	0.02
106 BREAD, CAKE, AND RELATED PRDDUCTS	90.902	SO.300	0.02
114 WINES, BRANDY, AND BRANDY SPIRITS	31.041	30.088	0.00
115 DISTILLED LIQUOR, EXCEPT BRANDY	33.652	30.188	0.01
116 BOTTLED AND CANNED SOFT DRINKS	SO.989	SO.187	0.01
126 FOOD PREPARATIONS, N.E.C	34.830	30.909	0.03
151 APPAREL MADE FROM PURCHASED MATERIAL	315.284	34.370	0.71

160	LOGGING CAMPS AND LOGGING CONTRACTOR	33.994	so.791	0.01
161	SAWMILLS AND PLANING MILLS, GENERAL	$5.704	31.596	0.06
162	HARDWOOD DIMENSION AND FLOORING MILL	30.260	$0.08.6	0.00
165	WOOD KITCHEN CABINETS	$0.050	SO.017	0.00
166	VENEER AND PLYUOOD	$1.018	SO.261	0.01
168	PREFABRICATED WOOD BUILDINGS	SO.003	sO.001	0.00
169	WOOD PRESERVING	31.209	30.206	0.01
172	WOOD PRODUCTS, N.E.C	33.246	SO.813	0.05
174	WOOD HOUSEHOLD FURNITURE	30.870	SO.278	0.01
183	WOOD PARTITIONS AND FIXTURES	$0.041	so.014	0.00
200	NEUSPAPERS	820.791	$7.501	0.23
205	COMMERCIAL PRINTING	83.088	31.015	0.05
225	PLASTICS MATERIALS AND RESINS	31.210	SO.257	0.01
229	DRUGS	so.688	SO.203	0.00
268	CONCRETE PRODUCTS, N.E.C	30.018	SO.006	0.00
269	READY-MIXED CONCRETE	30.202	30.048	0.00
276	MINERALS, GROUND OR TREATED	SO.043	$0.007	0.00
292	PRIMARY ALUMINUM	32.522	so.449	0.01
294	SECONDARY NONFERROUS METALS	SO.224	so.033	0.00
307	HEATING EQUIPMENT, EXCEPT ELECTRIC	30.023	30.007	0.00
311	SHEET METAL WORK	SO.228	SO.067	0.00
312	ARCHITECTURAL METAL WORK	30.060	90.023	0.00
329	FABRICATED METAL PRODUCTS, N.E.C.	SO.016	30.004	0.00
352	SPECIAL INDUSTRY MACHINERY, N.E.C.	80.028	SO.009	0.00
361	MACHINERY, EXCEPT ELECTRICAL, N.E.C.	30.012	SO.005	0.00
408	SHIP BUILDING AND REPAIRING	SO.050	SO.026	0.00
409	BOAT BUILDING AND REPAIRING	SO.229	SO.092	0.00
433	SPORTING AND ATHLETIC GOODS, N.E.C.	355.404	316.363	0.64
445	MANUFACTURING INDUSTRIES, N.E.C.	SO.097	SO.029	0.00
446	RAILROADS AND RELATED SERVICES	822.486	39.933	0.24
447	LOCAL, INTERURBAN PASSENGER TRANSIT	315.307	37.949	0.19
448	MOTOR FREIGHT TRANSPORT AND WAREHWS	313.325	85.552	0.21
449	WATER TRANSPORTATION	$3.191	80.503	0.01
450	AIR TRANSPORTATION	37.021	31.707	0.06
452	TRANSPORTATION SERVICES	30.990	so.377	0.03
453	ARRANGEMENT OF PASSENGER TRANSPORTAT	96.641	32.577	0.16
454	COMMUNICATIONS, EXCEPT RADIO AND TV	344.082	318.871	0.46
455	RADIO AND TV BROADCASTING	323.328	36.727	0.21
456	ELECTRIC SERVICES	32.399	30.319	0.01
457	GAS PRODUCTION AND DISTRIBUTION	333.689	32.336	0.07
458	WATER SUPPLY AND SEWERAGE SYSTEMS	so.197	80.031	0.00
459	SANITARY SERVICES AND STEAM SUPPLY	85.852	31.685	0.07
460	RECREATIONAL RELATED WHOLESALE TRADE	3163.754	367.471	0.62
461	OTHER WHOLESALE TRADE	336.438	$15.014	9.49
462	RECREATIONAL RELATED RETAIL TRADE	$1,044.280	$485.440	34.12
463	OTHER RETAIL TRADE	8151.969	$70.643	4.42
464	BANKING	836.943	814.132	0.65
465	CREDIT AGENCIES	$5.346	$3.955	0.19
466	SECURITY AND COMMODITY BROKERS	$0.455	$0.211	0.01
467	INSURANCE CARRIERS	$5.304	81.311	0.07

468	INSURANCE AGENTS AND BROKERS	81.664	SO.848	0.03
469	OWNER-OCCUPIED DWELLINGS	3168.080	90.000	0.00
470	REAL ESTATE	351.894	$2.616	0.35
471	HOTELS AND LODGING PLACES	9418.627	$120.681	15.56
472	LAUNDRY, CLEANING AND SHOE REPAIR	33.287	$1.233	0.13
473	FUNERAL SERVICE AND CREMATORIES	SO.798	SO.214	0.02
474	PORTRAIT AND PHOTOGRAPHIC STUDIOS	30.816	SO.228	0.02
475	ELECTRICAL REPAIR SERVICES	33.449	31.131	0.04
476	WATCH, CLOCK, JEWELRY AND FURNITURE	$0.893	so.319	0.01
477	BEAUTY AND BARBER SHOPS	$6.959	33.217	0.24
478	MISCELLANEOUS REPAIR SHOPS	$4.806	$1.390	0.06
479	SERVICES TO BUILDINGS	SO.461	SO.247	0.03
480	PERSONNEL SUPPLY SERVICES	SO.548	so.377	0.02
481	COMPUTER AND DATA PROCESSING SERVICE	92.445	31.064	0.02
482	MANAGEMENT AND CONSULTING SERVICES	$70.615	332.762	1.84
483	DETECTIVE AND PROTECTIVE SERVICES	30.515	30.319	0.02
484	EQUIPMENT REPAIR AND LEASING	315.603	93.623	0.14
485	PHOTOFINISHING, COMMERCIAL PHOTOGRAP	SO.310	80.095	0.00
486	OTHER BUSINESS SERVICES	34.911	$1.952	0.14
487	ADVERTISING	S4.696	31.818	0.06
488	LEGAL SERVICES	311.295	34.137	0.25
489	ENGINEERING, ARCHITECTURAL SERVICES	313.993	37.131	0.23
490	ACCOUNTING, AUDITING AND BOOKKEEPING	$10.234	$4.073	0.23
491	EATING AND DRINKING PLACES	3465.839	8135.058	11.99
492	AUTOMOBILE RENTAL AND LEASING	35.691	30.917	0.05
493	AUTOMOBILE REPAIR AND SERVICES	340.728	$11.130	0.64
494	AUTOMOBILE PARKING AND CAR WASH	30.505	30.094	0.01
495	MOTION PICTURES	31.328	so.339	0.07
496	DANCE HALLS, STUDIOS AND SCHOOLS	so.171	30.061	0.01
498	BOWLING ALLEYS AND POOL HALLS	31.638	so.477	0.08
499	COMMERCIAL SPORTS EXCEPT RACING	so.105	80.054	0.00
500	RACING AND TRACK OPERATION	so.155	30.029	0.00
501	MEMBERSHIP SPORTS AND RECREATION CLU	31.214	SO.362	0.08
502	AMUSEMENT AND RECREATION SERVICES, N	380.638	828.796	2.67
503	DOCTORS AND DENTISTS	361.737	326.084	0.87
504	HOSPITALS	360.676	329.956	1.63
505	NURSING AND PROTECTIVE CARE	39.612	34.724	0.37
506	OTHER MEDICAL AND HEALTH SERVICES	314.586	35.146	0.19
507	ELEMENTARY AND SECONDARY SCHOOLS	32.643	31.219	0.20
508	COLLEGES, UNIVERSITIES, SCHOOLS	$4.751	$2.957	0.18
509	OTHER EDUCATIONAL SERVICES	31.470	so.669	0.01
510	BUSINESS ASSOCIATIONS	so.451	30.175	0.04
511	LABOR AND CIVIC ORGANIZATIONS	82.812	31.172	0.34
512	RELIGIOUS ORGANIZATIONS	34.824	32.793	0.16
513	OTHER NONPROFIT ORGANIZATIONS	$1.044	30.505	0.05
514	RESIDENTIAL CARE	33.618	81.612	0.21
515	SOCIAL SERVICES, N.E.C.	310.331	$5.470	0.31
516	U.S. POSTAL SERVICE	313.970	313.132	0.34
518	OTHER FEDERAL GOVERNMENT ENTERPRISES	314.807	33.469	0.21
519	LOCAL GOVERNMENT PASSENGER TRANSIT	SO.722	31.058	0.03

520 STATE AND LOCAL ELECTRIC UTILITIES	891.855	$10.782	0.41
521 OTHER STATE AND LOCAL GOVT ENTERPRIS	847.169	$10.718	0.79
525 GOVERNMENT INDUSTRY	87.080	85.257	0.21
526 REST OF THE WORLD INDUSTRY	80.000	f0.000	0.00
527 HOUSEHOLD INDUSTRY	$3.616	$3.616	0.34
528 INVENTORY VALUATION ADJUSTMENT	~0.000	$0.000	0.00
VALUE ADDED	$1,187.21	$0.000	0.00
3005.118 3861.499	$3,861.499	1403.342905	105.04

RIVER CONSTRUCTION MODEL
SECTOR SPECIFIC IMPACTS
OUT-OF AREA CONTRACTOR
1989 DOLLARS

I	MPLAN SECTOR	INDUSTRIAL OUTPUT	VALUE ADDED	EMPLOYMENT
1	DAIRY FARM PRODUCTS	82.988	SO.181	0.03
2	POULTRY AND EGGS	$1.941	so.109	0.02
3	RANCH FED CATTLE	30.000	30.000	0.00
4	RANGE FED CATTLE	$0.099	80.006	0.00
5	CATTLE FEEDLOTS	SO.185	$0.039	0.00
6	SHEEP, LAMBS AND GOATS	30.000	30.000	0.00
7	HOGS, PIGS AND SWINE	30.000	fO.OOO	0.00
8	OTHER MEAT ANIMAL PRODU	30.000	30.000	0.00
9	MISCELLANEOUS LIVESTOCK	$0.637	$0.058	0.01
11	FOOD GRAINS	90.335	90.017	0.01
12	FEED GRAINS	80.202	SO.007	0.00
13	HAY AND PASTURE	80.747	90.025	0.01
14	GRASS SEEDS	30.028	SO.001	0.00
16	FRUITS	84.836	$1.016	0.16
17	TREE NUTS	to.311	80.067	0.01
18	VEGETABLES	86.699	$0.898	0.14
19	SUGAR CROPS	30.000	30.000	0.00
20	MISCELLANEOUS CROPS	$0.032	$0.002	0.00
22	FOREST PRODUCTS	80.053	80.005	0.00
23	GREENHOUSE AND NURSERY	$1.168	SO.412	0.07
24	FORESTRY PRODUCTS	82.586	90.183	0.01
26	AGRICULTURAL, FORESTRY,	82.457	30.775	0.10
27	LANDSCAPE AND HORTICULT	83.290	81.554	0.09
33	SILVER ORES	30.000	30.000	0.00
47	CRUSHED AND BROKEN STON	$194.078	$60.318	1.75
48	CONSTRUCTION SAND AND G	$70.915	322.908	0.75
66	NEW RESIDENTIAL STRUCTU	$799.193	3238.364	13.87
67	NEW INDUSTRIAL AND COMM	$198.652	3101.780	2.36
68	NEW UTILITY STRUCTURES	$645.386	$227.833	2.66
69	NEW HIGHWAYS AND STREET	30.000	30.000	0.00
70	NEW FARM STRUCTURES	30.000	30.000	0.00
72	NEW GOVERNMENT FACILITIES	$457.761	$177.920	3.91
73	MAINTENANCE AND REPAIR,	$18.279	86.135	0.20
74	MAINTENANCE AND REPAIR	t3.146	$1.478	0.10
93	CANNED FRUITS AND VEGET	$2.346	SO.373	0.01
95	PICKLES, SAUCES, AND SA	$4.278	SO.476	0.02
106	BREAD, CAKE, AND RELATE	SO.764	80.254	0.01
114	WINES, BRANDY, AND BRAN	80.878	80.074	0.00
115	DISTILLED LIPUOR, EXCEP	$2.789	SO.144	0.01
116	BOTTLED AND CANNED SOFT	$0.840	30.159	0.01
126	FOOD PREPARATIONS, N.E.	84.999	80.941	0.03
151	APPAREL MADE FROM PURCH	321.836	86.243	1.02
160	LOGGING CAMPS AND LOGGI	$40.682	58.056	0.13
161	SAWMILLS AND PLANING MI	$59.833	$16.743	0.58
162	HARDUOOD DIMENSION AND	$2.026	$0.672	0.03

165 WOOD KITCHEN CABINETS	$8.985	32.967	0.08
166 VENEER AND PLYUOOD	$15.068	53.859	0.20
168 PREFABRICATED WOOD BUILD	$0.055	to.011	0.00
169 WOOD PRESERVING	$8.880	31.514	0.09
172 WOOD PRODUCTS, N.E.C	$6.956	31.743	0.10
174 WOOD HOUSEHOLD FURNITUR	$1.322	SO.423	0.02
183 WOOD PARTITIONS AND FIX	30.508	30.168	0.01
200 NEWSPAPERS	314.539	$5.245	0.16
205 COMMERCIAL PRINTING	32.141	SO.703	0.04
225 PLASTICS MATERIALS AND	SO.246	30.052	0.00
229 DRUGS	$1.043	$0.309	0.01
268 CONCRETE PRODUCTS, N.E.	3122.406	$43.415	1.22
269 READY-MIXED CONCRETE	8413.981	398.907	2.53
276 MINERALS, GROUND OR TRE	30.859	$0.147	0.01
292 PRIMARY ALUMINUM	37.646	$1.361	0.03
294 SECONDARY NONFERROUS ME	SO.853	$0.127	0.00
307 HEATING EQUIPMENT, EXCE	so.109	30.032	0.00
311 SHEET METAL WORK	SO.997	$0.290	0.01
312 ARCHITECTURAL METAL WORK	30.429	SO.165	0.01
329 FABRICATED METAL PRODUC	311.336	33.164	0.50
352 SPECIAL INDUSTRY MACHIN	30.010	50.003	0.00
361 MACHINERY, EXCEPT ELECT	30.064	SO.027	0.00
408 SHIP BUILDING AND REPAI	30.145	30.076	0.00
409 BOAT BUILDING AND REPAI	30.310	30.124	0.00
433 SPORTING AND ATHLETIC G	82.488	80.735	0.03
445 MANUFACTURING INDUSTRIE	30.146	30.044	0.00
446 RAILROADS AND RELATED S	333.769	314.917	0.36
447 LOCAL, INTERURBAN PASSE	$2.175	31.130	0.03
448 MOTOR FREIGHT TRANSPORT	$40.290	316.788	0.64
449 WATER TRANSPORTATION	310.699	81.685	0.04
450 AIR TRANSPORTATION	39.725	32.364	0.08
452 TRANSPORTATION SERVICES	31.593	50.607	0.05
453 ARRANGEMENT OF PASSENGE	$32.152	$12.478	0.80
454 COMMUNICATIONS, EXCEPT	$52.162	322.330	0.55
455 RADIO AND TV BROADCAST1	314.948	$4.310	0.14
456 ELECTRIC SERVICES	34.217	80.560	0.02
457 GAS PRODUCTION AND DIST	331.850	$2.209	0.07
458 WATER SUPPLY AND SEWERA	SO.223	SO.035	0.00
459 SANITARY SERVICES AND S	$4.903	$1.412	0.06
460 RECREATIONAL RELATED WH	32.589	31.067	0.01
461 OTHER WHOLESALE TRADE	331.603	$13.021	8.23
462 RECREATIONAL RELATED RE	337.441	317.405	1.22
463 OTHER RETAIL TRADE	3379.721	3176.513	11.06
464 BANKING	354.292	320.769	0.96
465 CREDIT AGENCIES	$5.124	$3.777	0.18
466 SECURITY AND COMMDDITY	30.648	30.301	0.01
467 INSURANCE CARRIERS	37.388	31.826	0.10
468 INSURANCE AGENTS AND BR	917.123	SB.729	0.27
469 OWNER-OCCUPIED DWELLING	$254.864	so. 000	0.00
470 REAL ESTATE	3206.836	310.427	1.41
471 HOTELS AND LODGING PLAC	363.976	$18.443	2.38
472 LAUNDRY, CLEANING AND S	32.413	30.905	0.10
473 FUNERAL SERVICE AND CRE	31.205	30.323	0.03

474	PORTRAIT AND PHOTOGRAPH	31.241	$0.347	0.03
475	ELECTRICAL REPAIR SERVI	84.594	31.507	0.06
476	WATCH, CLOCK, JEWELRY A	31.355	30.485	0.02
477	BEAUTY AND BARBER SHOPS	310.552	34.878	0.36
478	MISCELLANEWS REPAIR SH	$10.258	$2.967	0.13
479	SERVICES TO BUILDINGS	30.318	30.171	0.02
480	PERSONNEL SUPPLY SERVIC	30.519	30.357	0.02
481	COMPUTER AND DATA PROCE	33.262	$1.420	0.03
482	MANAGEMENT AND CONSULT1	'543.249	320.065	1.13
483	DETECTIVE AND PROTECTIV	30.485	30.301	0.02
484	EQUIPMENT REPAIR AND LE	$16.553	83.844	0.15
485	PHOTOFINISHING, COMMERC	30.433	30.133	0.01
486	OTHER BUSINESS SERVICES	$4.228	$1.680	0.12
487	ADVERTISING	$2.936	$1.137	0.04
488	LEGAL SERVICES	312.743	$4.667	0.28
489	ENGINEERING, ARCHITECTU	3187.830	395.722	3.11
490	ACCOUNTING, AUDITING AN	39.442	33.757	0.22
491	EATING AND DRINKING PLA	3159.992	846.386	4.12
492	AUTOMOBILE RENTAL AND L	$24.817	83.999	0.23
493	AUTOMOBILE REPAIR AND S	$73.851	$20.183	1.17
494	AUTOMOBILE PARKING AND	30.571	30.106	0.01
495	MOTION PICTURES	$1.051	90.268	0.05
496	DANCE HALLS, STUDIOS AN	80.250	30.089	0.02
498	BOWLING ALLEYS AND POOL	32.484	30.724	0.12
499	COMMERCIAL SPORTS EXCEP	30.142	$0.074	0.01
500	RACING AND TRACK OPERAT	30.231	$0.042	0.00
501	MEMBERSHIP SPORTS AND R	31.664	$0.496	0.10
502	AMUSEMENT AND RECREATIO	$11.221	$4.007	0.37
503	DOCTORS AND DENTISTS	$93.608	339.549	1.33
504	HOSPITALS	$92.002	345.422	2.47
505	NURSING AND PROTECTIVE	$14.572	$7.162	0.56
506	OTHER MEDICAL AND HEALT	321.803	$7.691	0.28
507	ELEMENTARY AND SECONDAR	34.003	31.847	0.30
508	COLLEGES, UNIVERSITIES,	37.372	$4.589	0.27
509	OTHER EDUCATIONAL SERVI	$2.247	31.022	0.01
510	BUSINESS ASSOCIATIONS	30.434	$0.169	0.04
511	LABOR AND CIVIC ORGAN12	$4.252	31.773	0.51
512	RELIGIOUS ORGANIZATIONS	$7.320	34.238	0.25
513	OTHER NONPROFIT ORGAN12	$1.579	30.763	0.08
514	RESIDENTIAL CARE	35.485	32.444	0.31
515	SOCIAL SERVICES, N.E.C.	315.101	37.995	0.46
516	U.S. POSTAL SERVICE	314.053	$13.211	0.34
518	OTHER FEDERAL GOVERNMEN	322.606	35.296	0.31
519	LOCAL GOVERNMENT PASSEN	30.882	31.292	0.04
520	STATE AND LOCAL ELECTRI	339.041	$4.583	0.17
521	OTHER STATE AND LOCAL G	844.313	$10.069	0.74
525	GOVERNMENT INDUSTRY	$26.905	319.977	0.80
526	REST OF THE WORLD INDUS	$0.000	$0.000	0.00
527	HOUSEHOLD INDUSTRY	35.484	35.484	0.52
528	INVENTORY VALUATION ADJ	$0.000	30.000	0.00
	VALUE ADDED	$1,879.565	30.000	0.00
	TOTAL	$5,492.062	$1,800.554	83.67

Total and Margined Direct Expenditures by Model

REGION CONSTRUCTION
Local Contractor

TOTAL DIRECT EXPENDITURES	OUT-OF-AREA CONTRACTOR	LOCAL CONTRACTOR	RESEARCH	M&O	TOTAL DIRECT
47 CRUSHED ROCK	$516.531	$516.531	$0.000		$516.531
48 SAND AND GRAVEL	$254.501	$254.501	$0.000		$254.501
66 NEW RESID.	$466.869	$486.869	$0.000		$486.869
67 NEW INOUST.	$1.674.541	$4,186.353	$0.000		$4,186.353
68 NEW UTIL. STRUCT.	$2,560.952	$6,402.381	$404.567		$6,806.948
69 NEW HIGHWAYS	$1,096.476	$1,096.476	$0.000		$1,096.476
72 NEW GOVT. FACIL.	$1,871.398	$4,678.495	$0.000		$4,678.495
74 FACIL. MAINT.	$0.000	$0.000	$0.000	$1,196.464	$1,196.464
103 PREP. FEEDS	$0.000	$0.000	$0.000	$0.000	$0.000
267 CONCRETE BLOCKS	$322.842	$322.042	$0.000		$322.842
269 CONCRETE	$1,427.909	$1,427.909	$0.000		$1,427.909
308 METAL FABRICATION	$1,979.154	$1.979.154	$0.000		$1,979.154
365 OFFICE EQUIPMENT	$0.000	$0.000	$236.193		$236.193
413 METAL FABRICATION	$0.000	$0.000	$0.000	$11.319	$11.319
450 AIR CHARTER	$0.000	$0.000	$119.586		$119.586
453 TRAVEL AGENTS	$0.000	$0.000	$519.673		$519.673
461 WHOLESALE	$25.934	$37.049	$0.000	$09.733	$126.782
462 OTHER RETAIL	$0.000	$0.000	$53.446	$11.613	$65.059
463 RETAIL	$302.341	$335.934	$161.039	$93.066	$590.039
468 INSURANCE	$266.305	$665.762	$0.000		$665.762
470 REAL ESTATE	$899.921	$899.921	$150.308		$1,050.229
471 HOTELS AND LODGING	$0.000	$0.000	$160.356		$160.356
482 EATING AND DRINKING	$436.684	$436.684	$1,791.448		$2,228.132
489 (NOTE:MACK NOTES SHOW 481)	$0.000	$0.000	$866.133		$866.133
491 EATING AND DRINKING	$0.000	$0.000	$96.214		$96.214
492 AUTO RENTAL	$0.000	$0.000	$107.360	$55.042	$162.401
493 AUTO REPAIR	$82.000	$62.000	$107.360	$55.042	$244.401
518 OTHER FEDERAL	$436.682	$436.682	$0.000	$22.134	$458.816
520 ELECTRIC UTILITIES				$92.986	$92.986
525 GOVT INDUSTRY				$358.004	$358.004
TOTALS	$14,641.039	$24,245.542	$4,773.682	$1,985.403	$31,004.63

REGION CONSTRUCTION
Local Contractor

MARGINED DIRECT EXPENDITURES

47	**CRUSHED ROCK**	**516.5305**
48	**SAND AND GRAVEL**	254.5005
66	**NEW RESID.**	**486.8690**
67	**NEW INDUST.**	**4186.3535**
68	**NEW UTIL. STRUCT.**	**6806.9480**
69	**NEW HIGHWAYS**	**1096.4760**
72	**NEW GOVT. FACIL.**	**4678.4948**
74	**FACIL. MAINT.**	1196.4642
103	**PREP. FEEDS**	0.0000
267	**CONCRETE BLOCKS**	322.8417
269	**CONCRETE**	1427.9091
308	**METAL FABRICATION**	1979.1543
365	**OFFICE EQUIPMENT**	123.7980
413	**METAL FABRICATION**	8.1242
446	**RAILROADS**	3.1765
448	**MOTOR FREIGHT**	9.1236
449	**WATER TRANSPORT**	6.2337
450	**AIR CHARTER**	63.2913
453	**TRAVEL AGENTS**	519.6730
461	**WHOLESALE**	232.7627
462	**REC-RETAIL**	170.4236
463	**RETAIL**	515.5558
468	**INSURANCE**	666.4584
470	**OFFICE LEASING**	1050.2290
471	**HOTELS AND LODGING**	160.3560
482	**MANAG. AND CONSULTING**	2228.1319
489	**ENG AND ARCH**	866.1330
491	**EATING AND DRINKING**	96.2140
492	**AUTO RENTAL**	162.4012
493	**AUTO REPAIR**	241.9955
518	**OTHER FEDERAL**	458.8155
520	**ELECTRIC UTILITIES**	92.9860
525	**GOVT INDUSTRY**	358.0037

REGION CONSTRUCTION
Out of Area Contractor

TOTAL DIRECT EXPENDITURES	OUT-OF-AREA CONTRACTOR	LOCAL CONTRACTOR	RESEARCH	M&O	TOTAL DIRECT
47 CRUSHED ROCK	$516.531	$516.531	$0.000		$516.531
48 SAND AND GRAVEL	$254.501	$254.501	$0.000		$254.501
66 NEW RESID.	$486.869	$486.869	$0.000		$486.869
67 NEW INDUST.	$1,674.541	$4,186.353	$0.000		$1,674.541
68 NEW UTIL. STRUCT.	$2,560.952	$6,402.381	$404.567		$2,965.519
69 NEW HIGHWAYS	$1,096.476	$1,096.476	$0.000		$1,096.476
72 NEW GOVT. FACIL.	$1,871.398	$4,678.495	$0.000		$1,871.398
74 FACIL. MAINT.	$0.000	$0.000	$0.000	$1,196.464	$1,196.464
103 PREP. FEEDS	$0.000	$0.000	$0.000	$0.000	$0.000
267 CONCRETE BLOCKS	$322.842	$322.842	$0.000		$322.842
269 CONCRETE	$1,427.909	$1,427.909	$0.000		$1,427.909
308 METAL FABRICATION	$1,979.154	$1,979.154	$0.000		$1,979.154
365 OFFICE EDUIPMENT	$0.000	$0.000	$236.193		$236.193
413 METAL FABRICATION	$0.000	$0.000	$0.000	$11.319	$11.319
450 AIR CHARTER	$0.000	$0.000	$119.586		$119.586
453 TRAVEL AGENTS	$0.000	$0.000	$519.673		$519.673
461 WHOLESALE	$25.934	$37.049	$0.000	$89.733	$115.667
462 OTHER RETAIL	$0.000	$0.000	$53.446	$11.613	$65.059
463 RETAIL	$302.341	$335.934	$161.039	$93.066	$556.446
468 INSURANCE	$266.305	$665.762	$0.000		$266.305
470 REAL ESTATE	$899.921	$899.921	$150.308		$1,050.229
471 HOTELS AND LODGING	$0.000	$0.000	$160.356		$160.356
482 EATING AND DRINKING	$436.684	$436.684	$1,791.448		$2,228.132
489 (NOTE:MACK NOTES SHOW 4811	$0.000	$0.000	$866.133		$866.133
491 EATING AND DRINKING	$0.000	$0.000	$96.214		$96.214
492 AUTO RENTAL	$0.000	$0.000	$107.360	$55.042	$162.401
493 AUTO REPAIR	$82.000	$82.000	$107.360	$55.042	$244.401
518 OTHER FEDERAL	$436.682	$436.682	$0.000	$22.134	$458.816
520 ELECTRIC UTILITIES				$92.986	$92.986
525 GOVT INDUSTRY				$358.004	$358.004
TOTALS	$14,641.039	$24,245.542	$4,773.682	$1,985.403	$21,400.12

REGION CONSTRUCTION
Out of Area Contractor

MARGINED DIRECT EXPENDITURES

47	**CRUSHED ROCK**	**516.5305**
48	**SAND AND GRAVEL**	254.5005
66	**NEW RESID.**	**486.8690**
67	**NEW INDUST.**	**1674.5414**
68	**NEW UTIL. STRUCT.**	**2965.5194**
69	**NEW HIGHWAYS**	**1096.4760**
72	**NEW GOVT. FACIL.**	**1871.3979**
74	**FACIL. MAINT.**	**1196.4642**
103	**PREP. FEEDS**	**0.0000**
267	**CONCRETE BLOCKS**	**322.8417**
269	**CONCRETE**	1427.9091
308	**METAL FABRICATION**	1979.1543
365	**OFFICE EQUIPMENT**	123.7980
413	**METAL FABRICATION**	8.1242
446	**RAILROADS**	3.0082
448	**MOTOR FREIGHT**	8.6188
449	**WATER TRANSPORT**	5.9177
450	**AIR CHARTER**	63.2847
453	**TRAVEL AGENTS**	519.6730
461	**WHOLESALE**	**219.4439**
462	**REC-RETAIL**	**166.7513**
463	**RETAIL**	**489.9738**
468	**INSURANCE**	**266.9590**
470	**OFFICE LEASING**	**1050.2290**
471	**HOTELS AND LODGING**	**160.3560**
482	**MANAG. AND CONSULTING**	2228.1319
489	**ENG AND ARCH**	866.1330
491	**EATING AND DRINKING**	96.2140
492	**AUTO RENTAL**	162.4012
493	**AUTO REPAIR**	241.9955
518	**OTHCR FEDERAL**	458.8155
520	**ELECTRIC UTILITIES**	92.9860
525	**GOVT INDUSTRY**	358.0037

RIVER CONSTRUCTION MODEL

TOTAL DIRECT EXPENDITURES	OUT-OF-AREA CONTRACTOR	LOCAL CONTRACTOR	RESEARCH	M&O	TOTAL DIRECT
47 CRUSHED ROCK	**$144.815**	$144.815	**$0.000**		$144.815
48 SAND AND GRAVEL	**$53.011**	$53.011	**$0.000**		$53.011
66 NEW RESID.	$96.417	$96.417	**$0.000**		**$96.417**
67 NEW INDUST.	$154.596	$154.596	**$0.000**		$154.596
68 NEW UTIL. STRUCT.	$419.488	$419.488	$82.768		$502.256
69 NEW HIGHWAYS	$525.536	$525.536	$0.000		$525.536
72 NEW GOVT. FACIL.	$356.241	$356.241	$0.000		$356.241
74 FACIL. MAINT.	$0.000	$0.000	$0.000	**$0.000**	$0.000
103 PREP. FEEDS	$0.000	$0.000	$0.000	**$0.000**	$0.000
267 CONCRETE BLOCKS	$95.112	$95.112	$0.000		$95.112
269 CONCRETE	$320.093	$320.093	$0.000		$320.093
308 METAL FABRICATION	$8.777	$8.777	$0.000		$8.777
365 OFFICE EQUIPMENT	$0.000	$0.000	$32.894		$32.894
413 METAL FABRICATION	$0.000	$0.000	$0.000	**$0.000**	$0.000
450 AIR CHARTER	$0.000	$0.000	$0.000		$0.000
453 TRAVEL AGENTS	$0.000	$0.000	$23.924		$23.924
461 WHOLESALE	$0.750	$0.750	$0.000	**$0.000**	$0.750
462 OTHER RETAIL	$0.000	$0.000	$9.967	**$0.000**	$9.967
463 RETAIL	$87.349	$87.349	$22.427	**$0.000**	$109.776
468 INSURANCE	$11.408	$11.408	$0.000		$11.408
470 OFFICE LEASING	$99.603	$99.603	$20.934		$120.537
471 HOTELS AND LODGING	$0.000	$0.000	$29.905		$29.905
482 EATING AND DRINKING	$0.000	$0.000	$334.959		$334.959
489 ENGINEERING	$0.000	$0.000	$39.875		$39.875
491 EATING AND DRINKING	$0.000	$0.000	**$17.940**		$17.940
492 AUTO RENTAL	$0.000	$0.000	$14.953	**$1.691**	$16.644
493 AUTO REPAIR	$0.000	$0.000	$14.953	$1.691	$16.644
518 OTHER FEDERAL	$0.000	$0.000	$0.000	$0.000	$0.000
520 ELECTRIC UTILITIES				$0.000	$0.000
525 GOVT INDUSTRY				$20.938	$20.938
TOTALS	$2,373.196	$2,373.196	$645.498	$24.320	$3,043.01

RIVER CONSTRUCTION MODEL
MARGINED DIRECT EXPENDITURES

47	**CRUSHED ROCK**	**144.8150**
48	**SAN0 AND GRAVEL**	**53.0110**
66	**NEW RESID.**	96.4166
67	**NEW INDUST.**	154.5963
68	**NEW UTIL. STRUCT.**	502.2560
69	**NEW HIGHWAYS**	525.5360
72	**NEW GOVT. FACIL.**	356.2413
74	**FACIL. MAINT.**	0.0000
103	**PREP. FEEDS**	0.0000
267	**CONCRETE BLOCKS**	95.1120
269	**CONCRETE**	320.0930
308	**METAL FABRICATION**	8.7770
365	**OFFICE EQUIPMENT**	17.2410
413	**METAL FABRICATION**	0.0000
446	**RAILROADS**	0.4061
448	**MOTOR FREIGHT**	1.2534
449	**WATER TRANSPORT**	1.0012
450	**AIR CHARTER**	0.0243
453	**TRAVEL AGENTS**	23.9240
461	**WHOLESALE**	22.6527
462	**REC-RETAIL**	21.0783
463	**RETAIL**	86.5933
468	**INSURANCE**	11.5220
470	**OFFICE LEASING**	120.5370
471	**HOTELS AND LODGING**	29.9050
482	**MANAG. AND CONSULTING**	334.9590
489	**ENG AND ARCH**	39.8750
491	**EATING AN" DRINKING**	17.9400
492	**AUTO RENTAL**	16.6435
493	**AUTO REPAIR**	**16.4797**
518	**OTHER FEDERAL**	**0.0000**
520	**ELECTRIC UTILITIES**	**0.0000**
525	**GOVT INDUSTRY**	**20.9380**
	TOTALS	**3039.8276**

KIYAK CONSTRUCTION

TOTAL DIRECT EXPENDITURES	OUT-OF-AREA CONTRACTOR	LOCAL CONTRACTOR	RESEARCH	M&O	TOTAL DIRECT
47 CRUSHED ROCK	$371.716	$371.716	$0.000		$371.716
48 SAND AND GRAVEL	$201.490	$201.490	$0.000		$201.490
66 NEW RESID.	$349.131	$349.131	$0.000		$349.131
67 NEW INDUST.	$1,427.187	$3,567.968	$0.000		$1,427.187
68 NEW UTIL. STRUCT.	$1,889.772	$4,724.429	$321.799		$2,211.571
69 NEW HIGHWAYS	$570.940	$570.940	$0.000		$570.940
72 NEW GOVT. FACIL.	$1,301.412	$3.253.530	$0.000		$1,301.412
74 FACIL. MAINT.	$0.000	$0.000	$0.000	$1,196.464	$1,196.464
103 PREP. FEEDS	$0.000	$0.000	$0.000	$0.000	$0.000
267 CONCRETE BLOCKS	$227.730	$227.730	$0.000		$227.730
269 CONCRETE	$1,107.816	$1,107.816	$0.000		$1,107.816
308 METAL FABRICATION	$1.970.377	$1,970.377	$0.000		$1,970.377
365 OFFICE EQUIPMENT	$0.000	$0.000	$203.299		$203.299
413 MOBILE HOMES	$0.000	$0.000	$0.000	$11.319	$11.319
450 AIR CHARTER	$0.000	$0.000	$119.586		$119.586
453 TRAVEL AGENTS	$0.000	$0.000	$495.749		$495.749
461 WHOLESALE	$23.834	$34.049	$0.000	$89.733	$113.567
462 OTHER RETAIL	$0.000	$0.000	$43.479	$11.613	$55.092
463 RETAIL	$204.073	$226.748	$138.612	$93.066	$435.752
468 INSURANCE	$175.044	$437.609	$0.000		$175.044
470 OFFICE LEASING	$567.911	$567.911	$129.374		$697.285
471 HOTELS AND LODGING	$0.000	$0.000	$130.451		$130.451
482 EATING AND DRINKING	$436.684	$436.684	$1,456.489		$1,893.173
489 (NOTE:MACK NOTES SHOW 481)	$0.000	$0.000	$826.258		$826.258
491 EATING AND DRINKING	$0.000	$0.000	$78.274		$78.274
492 AUTO RENTAL	$0.000	$0.000	$92.407	$53.351	$145.758
493 AUTO REPAIR	$0.000	$0.000	$92.407	$53.351	$145.758
518 OTHER FEDERAL	$436.682	$436 682	$0.000	$22.134	$458.816
520 ELECTRIC UTILITIES				$92.986	$92.986
525 GOVT INDUSTRY				$337.066	$337.066
TOTALS	$11,261.798	$18,484.809	$4.128.184	$1,96!.C83	$17,351.06

KIYAK CONSTRUCTION

MARGINED DIRECT EXPENDITURES

47	**CRUSHED ROCK**	**371.7155**
48	**SAND AND GRAVEL**	201.4895
66	**NEW RESID.**	349.1310
67	**NEW INDUST.**	1427.1874
68	**NEW UTIL. STRUCT.**	2211.5706
69	**NEW HIGHWAYS**	570.9400
72	**NEW GOVT. FACIL.**	1301.4119
74	**FACIL. MAINT.**	1196.4642
103	**PREP. FEEDS**	0.0000
267	**CONCRETE BLOCKS**	227.7297
269	**CONCRETE**	**1107.8161**
308	**METAL FABRICATION**	**1970.3773**
365	**OFFICE EQUIPMENT**	**106.5570**
413	**MOBILE HOMES**	8.1242
446	**RAILROADS**	2.5625
448	**MOTOR FREIGHT**	7.2369
449	**WATER TRANSPORT**	4.8168
450	**AIR CHARTER**	63.2597
453	**TRAVEL AGENTS**	495.7490
461	**WHOLESALE**	**193.9549**
462	**REC-RETAIL**	**144.4220**
463	**RETAIL**	**395.0084**
468	**INSURANCE**	**175.5712**
470	**OFFICE LEASING**	**697.2850**
471	**HOTELS AND LODGING**	**130.4510**
482	**MANAG. AND CONSULTING**	1893.1729
489	**ENG AND ARCH**	826.2580
491	**EATING AND DRINKING**	78.2740
492	**AUTO RENTAL**	145.7577
493	**AUTO REPAIR**	**144.3229**
518	**OTHER FEDERAL**	**458.8155**
520	**ELECTRIC UTILITIES**	**92.9860**
525	**GOVT INDUSTRY**	337.0657
	TOTALS	17337.4845

RIVER HARVEST

TOTAL DIRECT EXPENDITURES		M&O TOTALS ($M)	RESEARCH TOTALS ($M)	SPORT FISHING TOTALS ($M)	INDIAN FISHING T'OTALS ($M)	TOTALS ($M)
68		$0.000	$12.065	$0.000	$18.124	$30.189
74	FACIL. MAINT.	$212.729	$0.000	$0.000	$0.000	$212.729
103	PREP. FEEDS	$163.470	$0.000	$0.000	$0.000	$163.470
365	OFFICE EQUIPMENT	$0.000	$5.380	$0.000	$0.000	$5.380
413	METAL FABRICATION	$0.000	$0.000	$0.000	$0.000	$0.000
433	SPORTING GOODS			$121.403	$34.381	$155.785
450	AIR CHARTER	$0.000	$0.000	$0.000	$0.000	$0.000
453	TRAVEL AGENCY	$0.000	$3.913	$0.000	$0.000	$3.913
461	OTHER WHOLESALE	$27.367	$0.000	$0.000	$0.000	$27.367
462	REC-RELATED RETAIL	$36.489	$1.630			$38.119
	GAS SERVICE STATIONS			$423.791	$61.887	$485.677
	GROCERY STORES			$216.608	$68.763	$285.371
463	OTHER RETAIL	$0.000	$3.668			$3.668
470	OFFICE LEASING	$0.000	$3.424			$3.424
471	HOTELS & LODG	$0.000	$4.891	$309.218	$0.000	$314.109
482	MGMT & CONSULT.	$0.000	$54.785			$54.785
484	EQUIPMENT RENTAL	$0.000	$0.000	$4.552	$0.000	$4.552
489	ENG AND ARCH	$0.000	$6.522			$6.522
491	EATING AN0 DRINKING	$0.000	$2.934	$224.813	$58.449	$286.196
492	VEHICLE RENTAL	$0.445	$2.446			$2.891
493	VEHICLE REPAIR	$0.445	$2.446			$2.891
499	COMMERCIAL RECREATION	$0.000	$0.000	$56.984	$0.000	$56.984
518	GOVT ENTERPRISE	$0.000	$0.000			$0.000
520	ELECTRIC UTILITIES	$41.597	$0.000			$41.597
521	STATE AND LOCAL GOVT	$0.000	$0.000	$9.982		$9.982
525	GOVT INDUSTRY	$5.510	$0.000			$5.510
	TOTALS	$488.052	$104.103	$1,245.949	$241.603	$2,079.707

KIYAK HARVEST

TOTAL DIRECT EXPENDITURES		M&O TOTALS ($M)	RESEARCH TOTALS ($M)	SPORT FISHIN TOTALS ($M)	INDIAN FISHING TOTALS ($M)	TOTALS ($M)
68		$0.000	$48.262	$0.000	$18.124	$66.386
74	FACIL. MAINT.	$709.927	$0.000	$0.000	$0.000	$709.927
103	PREP. FEEDS	$303.586	$0.000	$0.000	$0.000	$303.586
365	OFFICE EQUIPMENT	$0.000	$30.490	$0.000	$0.000	$30.490
413	METAL FABRICATION	$2.892	$0.000	$0.000	$0.000	$2.892
433	SPORTING GOODS			$254.367	$49.975	$304.342
450	AIR CHARTER	$0.000	$17.934	$0.000	$0.000	$17.934
453	TRAVEL AGENCY	$0.000	$74.351	$0.000	$0.000	$74.351
461	OTHER WHOLESALE	$74.438	$0.000	$0.000	$0.000	$74.438
462	REC-RELATED RETAIL	$92.027	$6.521			$98.548
	GAS SERVICE STATIONS			$922.423	$89.955	$1.012.377
	GROCERY STORES			$437.451	$99.950	$537.400
463	OTHER RETAIL	$3.056	$20.788			$23.844
470	OFFICE LEASING	$0.000	$19.402			$19.402
471	HOTELS & LODG	$0.000	$19.564	$759.717	$0.000	$779.281
482	MGMT & CONSULT.	$0.000	$221.968			$221.968
484	EQUIPMENT RENTAL	$0.000	$0.000	$14.504	$0.000	$14.504
489	ENG AND ARCH	$0.000	$123.918			$123.918
491	EATING AND DRINKIN	$0.000	$11.738	$495.583	$84.957	$592.278
492	VEHICLE RENTAL	$13.860	$13.859			$27.719
493	VEHICLE REPAIR	$13.860	$13.859			$27.719
499	COMMERCIAL RECREAT	$0.000	$0.000	$126.785	$0.000	$126.785
518	GDVT ENTERPRISE	$5.655	$0.000			$5.655
520	ELECTRIC UTILITIES	$101.722	$0.000			$101.722
521	STATE AND LOCAL GO	$0.000	$0.000	$22.033		$22.033
525	GOVT INDUSTRY	$86.118	$0.000			$86.118
	TOTALS	$1.407.141	$622.654	$3,032.862	$342.960	$5,405.617

KIYAK HARVEST MODEL
TOTAL MARGINED IMPACTS

68RES. CONSTRUCTION	$66.39
74FACIL MAINTENANCE	$709.93
103PREPARED FEEDS, NE	$211.73
414MOTOR HOMES	$2.08
433SPORTING AND ATHLE	$160.23
450AIR CHARTER	$17.93
453ARRANGEMENT OF PAS	$74.35
460REC-WHOLESALE	$258.14
4610THER WHOLESALE	$74.44
462REC-RETAIL	$887.39
4630THER RETAIL	$14.55
4700FFICE LEASING	$19.40
471HOTELS AND LODGING	$779.28
482MGT AND CONSLT	$221.97
484EQUIP RENTAL	$14.50
489ENG AND ARCH	$123.92
491EATING AND DRINKIN	$592.28
492AUTOMOBILE RENTAL	$27.72
493AUTOMOBILE REPAIR	$27.45
499COMMERCIAL SPORTS	$126.79
518STATE AND LOCAL GO	$22.03
520ELEC UTIL	$5.66
5210THER STATE AND LO	$101.72
525GOVT INDUSTRY	$86.12
	$4,625.975

RIVER HARVEST MODEL
TOTAL MARGINED IMPACTS

68	RES. CONSTRUCTION	$30.19
74	FACIL MAINTENANCE	$212.73
103	PREPARED FEEDS, NEC	$114.01
414	MOTOR HOMES	$0.00
433	SPORTING AND ATHLETIC G	$82.02
446	RAIL TRANSPORTATION	$7.85
448	MOTOR FREIGHT TRANSPORT	$10.56
450	AIR CHARTER	$0.00
453	ARRANGEMENT OF PASSENGE	$3.91
460	REC-WHOLESALE	$126.52
461	OTHER WHOLESALE	$27.37
462	REC-RETAIL	$445.65
463	OTHER RETAIL	$2.24
470	OFFICE LEASING	$3.42
471	HOTELS AND LODGING PLAC	$314.11
482	MGT AND CONSLT	$54.79
484	EQUIP RENTAL	$4.55
489	ENG AND ARCH	$6.52
491	EATING AND DRINKING PLA	$286.20
492	AUTOMOBILE RENTAL AND L	$2.89
493	AUTOMOBILE REPAIR AND S	$2.86
499	COMMERCIAL SPORTS EXCEP	$56.98
518	OTHER FEDERAL GOVT	$0.00
520	ELEC UTIL	$41.60
521	OTHER STATE AND LOCAL G	$9.98
525	GOVT INDUSTRY	$5.51
		$1,852.451

REGION HARVEST
TOTAL MARGINED IMPACTS

68RES. CONSTRUCTION	$78.45
74FACIL MAINTENANCE	$928.90
103PREPAREO FEEDS, NEC	$325.74
414MOTOR HOMES	$2.14
433SPORTING AND ATHLETI	$291.58
450AIR CHARTER	$17.93
453ARRANGEMENT OF PASSE	$78.26
460REC-WHOLESALE	$475.33
4610THER WHOLESALE	$102.29
462REC-RETAIL	.$1,570.73
4630THER RETAIL	$16.78
4700FFICE LEASING	$22.83
471HOTELS AND LODGING P	$1,520.19
482MGT AND CONSLT	$276.75
484EQUIP RENTAL	$26.57
489ENG AND ARCH	$130.44
491EATING AND DRINKING	$1,066.81
492AUTOMOBILE RENTAL AN	$31.11
493AUTOMOPILE REPAIR AN	$30.49
499COMMERCIAL SPORTS EX	$250.44
518STATE AND LOCAL GOVT	$43.64
520ELEC UTIL	$5.82
5210THER STATE AND LOCA	$143.72
525GOVT INDUSTRY	$99.72
REGION MODEL	$7,536.675

Construction Expenditures by County

CONSTRUCTION EXPENDITURES	KLICKITAT			
	HATCHERY	PHASE II	ENHANCEMENT	TOTALS
47 CRUSHED ROCK	$135,006		$9,809	$144,815
48 SAND AND GRAVEL	$43,202		$9,809	$53,011
66 NEW RESID.	$137,738		$0	$137,738
67 NEW INDUST.	$439,235		$179,150	$618,385
68 NEW UTIL. STRUCT.	$1,517,905		$160,047	$1,677,952
69 NEW HIGHWAYS	$491,461		$34,075	$525,536
72 NEW GOVT. FACIL.	$1,373,853		$51,112	$1,424,965
267 CONCRETE BLOCKS	$90,001		$5,111	$95,112
269 CONCRETE	$270,014		$50,079	$320,093
308 METAL FABRICATION	$0		$8,777	88,777
453 TRAVEL AGENTS	$0		so	$0
461 WHOLESALE	$0		$3,000	$3,000
463 RETAIL	$108,696		$490	$109) 186
468 INSURANCE	$228,153		$0	$228,153
470 REAL ESTATE	$332,010		$0	$332,010
471 HOTELS AND LODGING	$0		$0	$0
482 EATING AND DRINKING	$0		$0	$0
489 (NOTE:MACK NOTES SHOW 481) '481)			$0	$0
493 AUTO REPAIR	$0		$0	$0
518 OTHER FEDERAL	$0		$0	$0
TOTALS	$5,167,274	$0	$511,459	$5,678,733

CONSTRUCTION EXPENDITURES	==========YAKIMA COUNTy======KIyAK			
	HATCHERY	PHASE II	ENHANCEMENT	TOTAL
47 CRUSHED ROCK	$127,744	$65,060	$5,686	$198.490
48 SAND AND GRAVEL	$40,878	$65.060	$5,686	$111,624
66 NEW RESID.	$122,435			$122,435
67 NEW INDUST.	$753,066	$1,152.757	$100,860	$2,006,683
68 NEW UTIL. STRUCT.	$1,343,041	$1,042,971	$91,238	$2,477,250
69 NEW HIGHWAYS	$54,904	$219,573	$19,245	$293,722
72 NEW GOVT. FACIL.	$1,473,670	$329,359	$20,779	$1,831,808
267 CONCRETE BLOCKS	$05,159	$32,530	$2,884	$120,573
269 CONCRETE	$255,486	$325,301	$28,431	$609,218
308 METAL FABRICATION		$1,771,084	$154,866	$1,925,950
453 TRAVEL AGENTS				$0
461 WHOLESALE		$20,000	$1,749	$21,749
463 RETAIL	$152,174			$152,174
468 INSURANCE	$220,218			$220,218
470 REAL ESTATE	$279,587			$279,587
471 HOTELS AND LODGING				$0
482 EATING AND DRINKING		$401,606	$35,078	$436,684
489 (NOTE:MACK NOTES SHOW 481)				$0
493 AUTO REPAIR				$0
518 OTHER FEDERAL		$401,606	$35,076	$436,682
TOTALS	$4,908,362	$5,826,907	$509,577	$11,244,846

REGION CONSTRUCTION MODEL
LOCAL CONTRACTOR

CONSTRUCTION EXPENDITURES	KITTITAS			
	HATCHERY	PHASE II	ENHANCEMENT	TOTALS
47 CRUSHED ROCK	$122,589	$41,205	$9,432	$173,226
48 SAND AND GRAVEL	$39,229	$41,205	$9,432	$89,866
66 NEW RESID.	$226,696	$0	$0	$226,696
67 NEW INDUST.	$663,253	$730,080	$167,952	$1,561,285
68 NEW UTIL. STRUCT.	$1,434,783	$660,548	$151,848	$2,247,179
69 NEW HIGHWAYS	$106,175	$139,063	$31,980	$277,218
72 NEW GOVT. FACIL.	$1,165,043	$208,594	$48,085	$1,421,722
267 CONCRETE BLOCKS	$81,723	$20,602	$4,832	$107,157
269 CONCRETE	$245,179	$206,024	$47,395	$498,598
308 METAL FABRICATION	$0	$36,145	$8,282	$44,427
453 TRAVEL AGENTS	$0	$0	$0	$0
461 WHOLESALE	$0	$10,000	$2,300	$12,300
463 RETAIL	$71,739	$2,375	$460	$74,574
468 INSURANCE	$217,391	$0	$0	$217,391
470 REAL ESTATE	$288,324	$0	$0	$288,324
471 HOTELS AND LODGING	$0	$0	$0	$0
482 EATING AND DRINKING	$0	$0	$0	$0
489 (NOTE:MACK NOTES SHOW 481) '481)		$0	$0	$0
493 AUTO REPAIR	$0	$0	$0	$0
518 OTHER FEDERAL	$0	$0	$0	$0
TOTALS	$4,662,124	$2,095,841	$481,998	$7,239,963

Direct Expenditures for Research and Operations and Maintenance

DIRECT EXPENDITURES FOR RESEARCH

		KIYAK	KLICKITAT	REGION (Ml
68	CONSTRUCTION	$48,262	$12,065	$60.327
365	OFFICE EQUIPMENT	$30,490	$5,380	$35.870
450	AIR CHARTER	$17,934	$0	$17.934
453	TRAVEL AGENCY	$74,351	$3,913	$78.264
462	REC-RETAIL	$6,521	$1,630	$8.151
463	RETAIL	$20,788	$3,668	$24.456
470	OFFICE LEASING	$19,402	$3,424	$22.826
471	HOTELS & LODG	$19,564	$4,891	$24.455
482	MGMT & CONSULT.	$221,968	$54,785	$276.753
489	ENG AND ARCH	$123,918	$6,522	$130.440
491	EATING AND DRINKING	$11,738	$2,934	$14.672
492	AUTO RENTAL	$13,859	$2,446	$16.305
493	AUTO REPAIR	$13,859	$2,446	$16.305
	TOTAL	$622,654	$104,103	$726.757

OPERATIONS AND MAINTENANCE

		KITTITAS COUNTY				YAKIMA COUNTY			
		HATCHERY ($M)	PHASE II ($M)	ENHANCEMENT ($M)	TOTALS	HATCHERY	PHASE II	ENHANCE.	TOTALS
74	FACIL. MA	$194.495	$122.088		$316.583	$200.573	$192.771		$393.344
103	PREP. FEE	$149.458			$149.458	$154.128			$154.128
413	METAL FAB	$0.000		$1.157	$1.157	$0.000		$1.822	$1.822
461	OTHER WHO	$25.021	$9.157		$34.178	$25.803	$14.457		$40.260
463	RETAIL	$33.361	$7.631		$40.992	$34.404	$12.048	$4.812	$51.264
462	OTHER RET			$3.056	$3.056		$0.000		$0.000
492	VEHICLE R		$3.052	$2.396	$5.448		$4.820	$3.773	$8.592
493	VEHICLE REPAIR		$3.052	$2.396	$5.448		$4.820	$3.773	$8.592
518	GOVT ENTERPRISE			2.262	$2.262			$3.563	$3.563
520	ELECTRIC	$38.032	$7.631	$4.791	$50.454	$39.220	$12.048		$51.268
525	GOVT INDU			$34.448	$34.448			$54.254	$54.254
	TOTALS	$440.367	$152.611	$50.505	$643.483		$240.963	$71.995	$767.086

		KLICKITAT COUNTY						
		HATCHERY ($M)	PHASE II ($M)	ENHANCEMENT ($M)	TOTALS	TOTALS ($M)	TOTALS ($M)	BENTON
74	FACIL. MA	$212.729	$0.000	$0.000	$212.729	$212.729	$928.902	6.246
103	PREP. FEE	$163.470	$0.000	$0.000	$163.470	$163.470	$467.056	
413	METAL FAB	$0.000	$0.000	$0.000	$0.000	$0.000	$2.979	
461	OTHER WHO	$27.367	$0.000	$0.000	$27.367	$27.367	$102.287	0.482
463	RETAIL	$36.489	$0.000	$0.000	$36.489	$36.489	$129.147	0.402
462	OTHER RET	$0.000	$0.000	$0.000	$0.000	$0.000	$3.056	
492	VEHICLE R	$0.000	$0.000	$0.445	$0.445	$0.445	$14.806	0.321
493	VEHICLE R	0	$0.000	$0.445	$0.445	$0.445	$14.485	
518	GOVT ENTE				$0.000	$0.000	$5.825	
520	ELECTRIC	$41.597	$0.000	$0.000	$41.597	$41.597	$143.720	0.401
525	GOVT INDU	$0.000	$0.000	$5.510	$5.510	$5.510	$99.722	5.51
		$481.652	$0.000	$6.400	$488.052	$488.052	$1,898.621	

Operations and Maintenance

1991-95 ==========KLICKITAT CDUNTY==========REGION======

		HATCHERY ($M)	PHASE II ($M)	ENHANCEMENT ($M)	TOTALS ($M)	TOTALS ($M)
74	FACIL. MAINT.	$0.000	$0.000	$0.000	$0.000	1196.4642
103	PREP. FEEDS	$0.000	$0.000	$0.000	$0.000	0.0000
413	UNKNOWN SECTOR	$0.000	$0.000	$0.000	$0.000	11.3193
461	OTHER WHOLESALE	$0.000	$0.000	$0.000	$0.000	89.7332
463	RETAIL	$0.000	$0.000	$0.000	$0.000	93.0664
462	OTHER RETAIL	$0.000	$0.000	$0.000	$0.000	11.6128
492	VEHICLE RENTAL	$0.000	$0.000	$1.691	$1.691	55.0417
493	VEHICLE REPAIR	$0.000	$0.000	$1.691	$1.691	55.0417
518	GOVT ENTERPRISE	$0.000	$0.000	$0.000	$0.000	22.1337
520	ELECTRIC UTILIT	$0.000	$0.000	$0.000	$0.000	92.9860
525	GOVT INDUSTRY	$0.000	$0.000	$20.938	$20.938	358.0037
	TOTALS	$0.000	$0.000	$24.320	$24.320	1985.4025

Operations and Maintenance

1991-95		KITTITAS COUNTY				YAKIMA COUNTY				
		HATCHERY ($M)	PHASE II ($M)	ENHANCEMENT ($M)	TOTALS	HATCHERY	PHASE II	ENHANCEME	TOTALS	
74	FACIL. MAINT.	$0.000	$463.934	$0.000	$463.934	74	$0.000	$732.530	$0.000	$732.530
103	PREP. FEEDS	$0.000	$0.000	$0.000	$0.000	103	$0.000	$0.000	$0.000	$0.000
413	UNKNOWN SECTOR	$0.000	$0.000	$4.397	$4.397	413	$0.000	$0.000	$6.923	$6.923
461	OTHER WHOLESALE	$0.000	$34.797	$0.000	$34.797	461	$0.000	$54.937	$0.000	$54.937
463	RETAIL	$0.000	$28.998	$0.000	$28.998	463	$0.000	$45.782	$18.286	$64.069
462	OTHER RETAIL	$0.000	$0.000	$11.613	$11.613	462	$0.000	$0.000	$0.000	$0.000
492	VEHICLE RENTAL	$0.000	$11.598	$9.103	$20.701	492	$0.000	$18.314	$14.336	$32.650
493	VEHICLE REPAIR	$0.000	$11.598	$9.103	$20.701	493	$0.000	$18.314	$14.336	$32.650
518	GOVT ENTERPRISE	$0.000	$0.000	$8.596	$8.596	518	$0.000	$0.000	$13.538	$13.538
520	ELECTRIC UTILIT	$0.000	$28.998	$18.206	$47.204	520	$0.000	$45.782	$0.000	$45.782
525	GOVT INDUSTRY	$0.000	$0.000	$130.902	$130.902	525	$0.000	$0.000	$206.163	$206.163
	TOTALS	$0.000	$579.922	$191.919	$771.841		$0.000	$915.659	$273.582	*********

APPENDIX J

MARGIN FACTORS

IMPLAN MARGIN FACTORS

IMPLAN	INDUSTRY	PROD.'S VALUE	RAIL MARGIN	TRUCK MARGIN	WATER MARGIN	AIR MARGIN	PIPE MARGIN	WHOLESALE MARGIN	RETAIL MARGIN	INSUR-ANCE
47	CRUSHED ROCK	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
48	SAND AND GRAVEL	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
66	NEW RESID.	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
67	NEW INDUST.	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
68	NEW UTIL. STRUC	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
69	NEW HIGHWAYS	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
72	NEW GOVT. FACIL	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
74	FACIL. MAINT.	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
103	PREP. FEEDS	69.74%	0.83%	0.45%	0.00%	0.00%	0.00%	6.88%	22.09%	0.00%
267	CONCRETE BLOCKS	100.00%	0.00%	O.ObX	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
269	CONCRETE	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
308	METAL FABRICATI	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
365	OFFICE EQUIPMEN	52.41%	0.04%	0.07%	0.00%	0.05%	0.00%	14.11%	33.32%	0.00%
413	METAL FABRICATI	71.77%	0.00%	0.04%	0.00%	0.00%	0.00%	0.65%	27.54%	0.00%
450	AIR CHARTER	52.65%	0.05%	0.21%	0.56%	0.07%	0.00%	8.96%	37.49%	0.00%
453	TRAVEL AGENTS	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
461	WHOLESALE	64.88%	0.66%	1.57%	0.13%	0.06%	0.00%	8.98%	22.71%	0.07%
462	OTHER RETAIL	61.01%	0.81%	1.41%	0.15%	0.06%	0.01%	7.26%	29.95%	0.00%
463	RETAIL	65.22%	0.28%	0.98%	0.90%	0.00%	0.96%	15.21%	14.35%	0.10%
468	INSURANCE	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
470	OFFICE LEASING	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
471	HOTELS AND LODG	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
482	EATING AND DRIN	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
489	(NOTE:MACK NOTE	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
491	EATING AND DRIN	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
492	AUTO RENTAL	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
493	AUTO REPAIR	99.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.22%	0.77%	0.00%
518	OTHER FEDERAL	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
520	ELECTRIC UTILIT	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
525	GOVT INDUSTRY	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

IMPLAN MARGIN FILE

IMPLAN IN	DESCRIPT	PROD.'S VALUE	RAIL MARGIN	TRUCK MARGIN	WATER MARGIN	AIR MARGIN	PIPE MARGIN	WHOLESALE MARGIN	RETAIL MARGIN	INSUR-ANCE
68	RES. CONS	100.00%	**0.00%**	**0.00%**	**0.00%**	**0.00%**	**0.00%**	**0.00%**	**0.00%**	**0.00%**
74	FACIL MA1	100.00%	**0.00%**	**0.00%**	**0.00%**	**0.00%**	**0.00%**	**0.00%**	**0.00%**	**0.00%**
103	PREPARED	69.74%	0.83%	0.45%	**0.00%**	**0.00%**	**0.00%**	6.88%	**22.09%**	**0.00%**
365	TYPEWRITE	52.41%	0.04%	0.07%	**0.00%**	**0.05%**	**0.00%**	**14.11%**	33.32%	**0.00%**
414	MOTOR HOM	71.77%	0.00%	0.04%	**0.00%**	**0.00%**	**0.00%**	0.65%	27.54%	**0.00%**
433	SPORTING	52.65%	0.05%	0.21%	0.56%	0.07%	**0.00%**	8.96%	37.49%	**0.00%**
450	AIR CHART	100.00%	0.00%	0.00%	0.00%	0.00%	**0.00%**	0.00%	0.00%	**0.00%**
453	ARRANGEME	100.00%	0.00%	0.00%	0.00%	0.00%	**0.00%**	0.00%	0.00%	**0.00%**
4610	THER WHO	100.00%	0.00%	0.00%	0.00%	0.00%	**0.00%**	0.00%	0.00%	**0.00%**
462	RETAIL GR	64.88%	0.66%	1.57%	0.13%	0.06%	**0.00%**	8.98%	22.71%	0.07%
462	RETAIL GA	66.77%	0.29%	1.02%	0.93%	0.00%	**0.97%**	15.37%	15.14%	0.10%
	DUMMY	**100.00%**	0.00%	0.00%	0.00%	0.00%	**0.00%**	0.00%	0.00%	0.00%
4630	THER RET	**61.01%**	0.81%	1.41%	0.15%	0.06%	0.01%	7.26%	29.95%	0.00%
4700	FFICE LE	**100.00%**	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
471	HOTELS AN	**100.00%**	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
482	MGT AND C	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
484	EQUIP REN	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
489	ENG AND A	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
491	EATING AN	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
492	AUTOMOBIL	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
493	AUTOMOBIL	99.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.22%	0.77%	0.00%
499	COMMERCIA	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
520	ELEC UTIL	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
5210	THER STA	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
518	STATE AND	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
525	GOVT INDU	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

APPENDIX K

DIRECT EXPENDITURES FOR THE YEARS 1990 THROUGH 2015, BY COUNTY

APPENDIX K

DIRECT EXPENDITURES FOR THE YEARS 1990 THROUGH 2015, BY COUNTY

Table K.l. Direct Impacts for Yakima County, 1990-1995.

Implan #	Description	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Construction																												
47	Crushed Stone	20,853	60,773	60,773	60,773	39,920																						243,090
48	Sand and Gravel	20,853	33,627	33,627	33,627	12,774																						134,508
66	Res. Structures		38.261	38,261	38,261	38,261																						153,044
67	Indust. Structures	369,483	604,817	604,817	604,817	235,333																						2,419,266
68	Utility Structures	334,293	753,993	753,993	753,993	419,700																						3,015,974
69	Highway and Street	70,381	87,538	87,538	87,538	17,158																						350,154
72	Govt. Facilities	105,563	566,085	566,085	566,085	460,522																						2,264,340
267	Concrete Block	10,430	37,042	37,042	37,042	26,612																						148,169
269	Ready-Mixed Conc.	104,263	184,103	184,103	184,103	79,839																						736,410
308	Fabricated Metals	567,662	567,662	567,662	567,662																							
453	Travel Agency																											
461	Other Wholesale	6,410	6,410	6,410	6,410																							25,641
463	Other Retail		47,554	47,554	47,554	47,554																						190,2113
468	Ins. Agents\Brok.		68.818	68,818	68,818	68,818																						275,2713
470	Real Estate		87,371	87,371	87,371	87.371																						349,4811
471	Hotels and Lodging																											
481	Computer Services	128.718	128.718	128.718	128.718																							514,871
489	Engineering\Arch. Serv.																											
491	Eat\Drink. Places																											
493	Auto Repair\Service																											514,871
518	Fed. govt. Enter.	128.718	128.718	128,718	128.718																							12,270,6481
Operations and Maintenance																												
	Harvest																											
74	Maint. and Repair							250,716	250,716	250,716	250,716	250,716	250,716	250,716	250,716	250,716	250,716	250,716	250,716	250,716	250,716	250,716	250,716	250,716	250,716	250,716	250,7186	5,014,325
103	Prepared Feeds, N.E.C							192,660	192,660	192,660	192,660	192,660	192,660	192,660	192,660	192,660	192,660	192,660	192,660	192,660	192,660	192,660	192,660	192,660	192,660	192,660	192,6610	3,853,200
461	Other Wholesale							32,254	32,254	32,254	32,254	32,254	32,254	32,254	32.254	32,254	32,254	32,254	32,254	32,254	32,254	32,254	32,254	32,254	32,254	32,254	32,254	645,075
463	Other Retail							43,005	43,005	43,005	43,005	43,005	43,005	43,005	43,005	43,005	43,005	43.005	43,005	43,005	43,005	43,005	43,005	43,005	43,005	43,005	43,005	860,100
520	St. and Loc. Utility							49,025	49,025	49,025	49,025	49,025	49,025	49,025	49,025	49,025	49,025	49,025	49,025	49,025	49,025	49,025	49,025	49,025	49,025	49,025	49,025	980,500
	Phase II																											
74	Maint. and Repair	96,386	144,578	192,771	240,964	240,964	240,964	240,964	240,964	240,964	240,964	240,964	240,964	240.964	240,964	240,964	240,964	240,964	240,964	240,964	240,964	240,964	240,964	240,964	240,964	240,964	240,964	5,734,937
461	Other Wholesale	7,229	10,843	14,457	18,071	18,071	18,071	18.071	18,071	18,071	18,071	18,071	18,071	18,071	18,071	18,071	18,071	18,071	18,071	18,071	18,071	18,071	18,071	18,071	18,071	18,071	18.071	430,096
463	Other Retail	6,024	9,036	12,048	15,060	15,060	15,060	15,060	15,060	15,060	15,060	15,060	15,060	15,060	15,060	15,060	15,060	15,060	15,060	15,060	15,060	15,060	15,060	15,060	15,060	15,060	15,060	358,428
493	Auto Rep.\Service	4,820	7,229	9,639	12,049	12,049	12,049	12,049	12,049	12,049	12,049	12,049	12,049	12,049	12,049	12,049	12,049	12,049	12,049	12,049	12,049	12,049	12,049	12,049	12,049	12,049	12,049	286,760
520	St. and Loc. Utility	6,024	9,036	12,048	15,060	15,060	15,060	15,060	15,060	15,060	15,060	15,060	15,060	15,060	15,060	15,060	15,060	15,060	15,060	15,060	15,060	15,060	15,060	15,060	15,060	15,060	15,0610	358,428
	Enhancement																											
413	Mobile Homes	542	1,084	1,627	2,169	2,169	2,169	2,169	2,169	2,169	2,169	2,169	2,169	2,169	2,169	2,169	2,169	2,169	2,169	2,169	2,169	2,169	2,169	2,169	2,169	2,169	2,169	50,966
462	Recr. Retail	1,432	2,864	4,297	5,729	5,729	5,729	5,729	5,729	5,729	5,729	5,729	5,729	5,729	5,729	5,729	5,729	5,729	5,729	5,729	5,729	5,729	5,729	5,729	5,729	5,729	5,729	134,626
518	Fed. Govt. Enter.	1,060	2,121	3,181	4.241	4,241	4,241	4,241	4,241	4,241	4.241	4,241	4,241	4,241	4,241	4,241	4,241	4,241	4,241	4,241	4,241	4,241	4,241	4,241	4,241	4,241	4,241	99,669
520	St. and Loc. Utility	2,246	4,491	6,737	8,983	8.983	8,983	8,983	8,983	8,983	8,983	8,983	8,983	8,983	8,983	8,983	a, 983	8,983	a, 983	8,983	a, 983	8.983	8,983	8.983	8.983	8.983	8.983	211.089
525	Govt. Industry	16,148	32,296	48,443	64,591	64.591	64,591	64,591	64,591	64,591	64,591	64,591	64,591	64,591	64,591	64,591	64,591	64,591	64,591	64,591	64,591	64,591	64,591	64,591	64,591	64,591	64,5911	1,517,894
Experimentation and Monitoring																												
68	Utility Structures	72752.5	72752.5	44663.75	44663.75	44663.75	44663.75	37705	37705	37705	37705	37705	37705	37705	37705	37705	37705	37705	37705	37705	37705	37705	37705	37705	37705	37705	37705	1078260
365	Office Mach. N.E.C	56236.25	56236.25	34523.75	34523.75	34523.75	34523.75	29145	29145	29145	29145	29145	29145	29145	29145	29145	29145	29145	29145	29145	29145	29145	29145	29145	29145	29145	29145	833467.5
450	Air Transportation	38932.5	38932.5	23901.25	23901.25	23901.25	23901.25	20176.25	20176.25	20176.25	20176.25	20176.25	20176.25	20176.25	20176.25	20176.25	20176.25	20176.25	20176.25	20176.25	20176.25	20176.25	20176.25	20176.25	20176.25	20176.25	20176.25	576995
453	Travel Agency	141573.75	141573.75	86913.75	86913.75	86913.75	86913.75	73372.5	73372.5	73372.5	73372.5	73372.5	73372.5	73372.5	73372.5	73372.5	73372.5	73372.5	73372.5	73372.5	73372.5	73372.5	73372.5	73372.5	73372.5	73372.5	73372.5	2(198252.5
462	Recr. Retail	8847.5	8847.5	5431.25	5431.25	5431.25	5431.25	4585	4585	4585	4585	4585	4585	4585	4585	4585	4585	4585	4585	4585	4585	4505	4585	4585	4585	4585	4585	131120
463	Other Retail	38342.5	38342.5	23538.75	23538.75	23538.75	23538.75	19871.25	19871.25	19871.25	19871.25	19871.25	19871.25	19871.25	19871.25	19871.25	19871.25	19871.25	19871.25	19871.25	19871.25	19871.25	19871.25	19871.25	19871.25	19871.25	19871.25	568265
470	Real Estate	35786.25	35786.25	21970	21970	21970	21970	18546.25	18546.25	18546.25	18546.25	18546.25	18546.25	18546.25	18546.25	18546.25	18546.25	18546.25	18546.25	18546.25	18546.25	18546.25	18546.25	18546.25	18546.25	18546.25	18546.25	530377.5
471	Hotels and Lodging	26543.75	26543.75	16295	16295	16295	16295	13756.25	13756.25	13756.25	13756.25	13756.25	13756.25	13756.25	13756.25	13756.25	13756.25	13756.25	13756.25	13756.25	13756.25	13756.25	13756.25	13756.25	13756.25	13756.25	13756.25	393392.5
482	Mgmt.\Consult. Serv.	330338.75	330338.75	206336.25	206336.25	206336.25	206336.25	174737.5	174737.5	174737.5	174737.5	174737.5	174737.5	174737.5	174737.5	174737.5	174737.5	174737.5	174737.5	174737.5	174737.5	174737.5	174737.5	174737.5	174737.5	174737.5	174737.5	4980772.5
489	Engineering\Arch. Serv.	251686.25	251686.25	154515	154515	154515	154515	130440	130440	130440	130440	130440	130440	130440	130440	130440	130440	130440	130440	130440	130440	130440	130440	130440	130440	130440	130440	3730232.5
491	Eat\Drink. Places	15926.25	15926.25	9777.5	9777.5	9777.5	9777.5	8253.75	8253.75	8253.75	8253.75	8253.75	8253.75	8253.75	8253.75	8253.75	8253.75	8253.75	8253.75	8253.75	8253.75	8253.75	8253.75	8253.75	8253.75	8253.75	8253.75	236037.5
492	Auto Rental\Leasing	51122.5	51122.5	65135	65135	65135	65135	26495	26495	26495	26495	26495	26495	26495	26495	26495	26495	26495	26495	26495	26495	26495	26495	26495	26495	26495	26495	892685
Harvest																												
433	Sporting Goods									14,829	14,071	16,583	19,544	23,034	27.147	31,994	37,706	44,438	52,373	61,724	72,745	85.734	101,042	119.083	140,345	165,403	194,936	1,219,840
462	Recr. Retail									58,021	69,088	93,962																
471	Hotels and Lodging									25,600	30,171	81,423	41,906	113.096	133,289	157,088	185,136	218,192	257,150	303,064	357.177	420,951	496,112	584,693	689.090	812.127	957,132	5,989,390
484	Equip. Rep.\Leas.									489	576	35,558	58,207	68,600	80,449	95,284	112,297	132,348	155,979	183,829	216,651	255,335	300.925	354,655	417,979	2,615,560
491	Eat\Drink. Places									22,425		679	800	943	1,111	1,310	1,544	1,819	2,144	2,527	2.978	3,510	4,136	4,875	5.745	6.771	7,980	49,934
499	Comm. Sports									4,272	26,429	31,148	36,709	43,264	50,988	60,092	70,822	83,467	98,370	115,934	136,634	161,030	189.782	223,668	263,604	310,671	366,141	2,291,179
521	Other St.\Loc. Enter.									742	5,035	5,934	6,994	8,242	9,714	11,448	13,492	15,902	18,741	22,087	26,031	30.678	36,156	42,612	50,220	59,187	69,755	436.499
											875	1,031	1,215	1,432	1,688	1,990	2,345	2,764	3,257	3,838	4,524	5,332	6,284	7,405	8,720	10,286	12.123	75,859
	Totals	1,068,089	3,077,625	4,318,069	4,399,738	4,481,407	2,613,781	1,511,660	1,511,660	1,511,660	1,511,660	1,511,660	1,511,660	1,511,660	1,511,660	1,511,660	1,511,660	1,511,660	1,511,660	1 . 5 1 1 3 6 6 0	1,511,660	1,511,660	1,511,660	,511,660	1.511.660	1.511.660			

Source: Derived from information presented in Tables 5.2-5.9.

Table K.2. Direct Impacts for the Aggregation of Kittitas County, 1990-1995.

Implan #	Description	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	a009	2010	2011	2012	2013	2014	2015	Total
Construction																												
47	Crushed Stone		15,824	54,133	54,133	54,133	38,309																					216.533
48	Sand and Gravel		15,824	28,083	28,083	28,083	12,259																					112,333
66	Res. Structures			49,590	49,590	49,590	49,590																					198,355
67	Indust. Structures		70,159	121,975	121.975	121.975	51,817																					487,902
68	Utility Structures		63,468	175,561	175,561	175,561	112,092																					702,243
69	Highway and Street		53,451	86,631	86,631	86,631	33,180																					346,523
72	Govt. Facilities		20,053	111,072	111,072	111,072	91,019																					444,288
267	Concrete Block		7,948	33,487	33,487	33,487	25,538																					133,946
269	Ready-Mixed Conc.		79,193	155,812	155,812	155,812	76,618																					623,248
308	Fabricated Metals		13,883	13,883	13,883	13,883																						0
453	Travel Agency																											0
461	Other Wholesale		961	961	961	961																						3,844
463	Other Retail		709	18,644	18,644	18,644	17,935																					74,574
468	Ins. Agents\Brok.			3,397	3,397	3,397	3,397																					13,587
470	Real Estate			27,030	27,030	27,030	27,030																					108,122
471	Hotels and Lodging																											0
481	Computer Services																											0
489	Engineering\Arch. Serv																											0
491	Eat\Drink. Places																											0
493	Auto Repair\Service																											0
518	Fed. govt. Enter.																											55,534
Operations and Maintenance																												0
Harvest																												
74	Maint. and Repair							243,119	243,119	243,119	243,119	243,119	243,119	243,119	243,119	243,119	243,119	243,119	243,119	243,119	243,119	243,119	243,119	243,119	243,119	243,119	243,119	4,862,375
103	Prepared Feeds, N.E.C							186,823	186,823	186,823	186.823	186.823	186,823	186,823	186,823	186.823	186,823	186,823	186,823	186,823	186,823	186,823	186,823	186,823	186,823	186,823	186,823	3,736,450
461	Other Wholesale							7,819	7,819	7,819	7,819	7,819	7,819	7,819	7,819	7,819	7,819	7,819	7,819	7,819	7,819	7,819	7,819	7,819	7,819	7.819	7,819	156,381
463	Other Retail							33,361	33,361	33,361	33,361	33,361	33,361	33,361	33,361	33,361	33,361	33,361	33,361	33,361	33,361	33,361	33,361	33,361	33,361	33,361	33,361	667,220
520	St. and Loc. Utility							47,540	47,540	47,540	47,540	47,540	47,540	47.540	47,540	47,540	47,540	47,540	47,540	47,540	47,540	47,540	47,540	47,540	47,540	47,540	47.540	950,800
Phase II																												
74	Maint. and Repair		61,044	91,566	122,088	152,610	152,610	152.610	152,610	152,610	152,610	152,610	152,610	152,610	152,610	152,610	152,610	152,610	152,610	152,610	152,610	152,610	152,610	152,610	152,610	152,610	152.610	3,632,118
461	Other Wholesale		3,663	5,494	7,326	9,157	9,157	9,157	9,157	9,157	9,157	9,157	9,157	9,157	9,157	9,157	9,157	9,157	9,157	9,157	9,157	9,157	9,157	9,157	9,157	9,157	9,157	217,937
463	Other Retail		3,052	4,579	6,105	7,631	7,631	7,631	7,631	7,631	7,631	7,631	7,631	7,631	7,631	7,631	7,631	7,631	7,631	7,631	7,631	7,631	7,631	7,631	7,631	7,631	7,631	181,618
493	Auto Rep.\Service		3,052	4,578	6,104	7,630	7,630	7,630	7,630	7,630	7,630	7,630	7,630	7,630	7,630	7,630	7,630	7,630	7,630	7,630	7,630	7,630	7,630	7,630	7,630	7,630	7,630	181,594
520	St. and Loc. Utility		3,816	5,723	7,631	9,539	9,539	9,539	9,539	9,539	9,539	9,539	9,539	9,539	9,539	9,539	9,539	9,539	9,539	9,539	9,539	9,539	9,539	9,539	9,539	9,539	9.539	227,022
Enhancement																												
413	Mobile Homes		362	723	1,085	1,446	1,446	1,446	1,446	1,446	1,446	1,446	1,446	1,446	1,446	1,446	1,446	1,446	1,446	1,446	1,446	1,446	1,446	1,446	1,446	1,446	1,446	33,987
462	Recr. Retail		955	1.910	2.865	3.820	3,820	3,820	3,820	3,820	3,820	3,820	3,820	3,820	3,820	3,820	3,820	3,820	3,820	3,820	3,820	3,820	3,820	3,820	3,820	3,820	3,820	89,770
518	Fed. Govt. Enter.		707	1,414	2,121	2,828	2,828	2,828	2,828	2,828	2,828	2,828	2,828	2,828	2,828	2,828	2,828	2,828	2,828	2,828	2,828	2,828	2,828	2,828	2,828	2,828	2,828	66,446
520	St. and Loc. Utility		1,497	2,994	4,492	5,989	5,989	5,989	5,989	5,989	5,989	5,989	5,989	5,989	5,989	5,989	5,989	5,989	5,989	5,989	5,989	5,989	5,989	5,989	5,989	5,989	5,989	140.736
525	Govt. Industry		10,765	21,530	32,295	43,060	43,060	43,060	43,060	43,060	43,060	43,060	43,060	43,060	43,060	43,060	43,060	43,060	43,060	43,060	43,060	43,060	43,060	43,060	43,060	43,060	43.060	1,011,910
Experimentation and Monitoring																												
68	Utility Structures	10,913	10,913	6,699	6.699	6.699	6,699	5,656	5,656	5,656	5,656	5,656	5,656	5,656	5,656	5,656	5,656	5,656	5,656	5,656	5,656	5,656	5,656	5,656	5,656	5,656	5,656	161735.625
365	Office Mach. N.E.C	17,303	17,303	10,623	10,623	10,623	10,623	8,968	8,968	8,968	8,968	8,968	8,968	8,968	8,968	8,968	8,968	8,968	8,968	8,968	8,968	8,968	8,968	8,968	8,968	8,968	8,968	256445
450	Air Transportation	4,325	4,325	2,655	2,655	2,655	2,655	2,241	2,241	2,241	2,241	2,241	2,241	2,241	2,241	2,241	2,241	2,241	2,241	2,241	2,241	2,241	2,241	2,241	2,241	2,241	2,241	64095
453	Travel Agency	15,101	15,101	9,271	9,271	9,271	9,271	7,827	7,827	7,827	7,827	7,827	7,827	7,827	7,827	7,827	7,827	7,827	7,827	7,827	7,827	7,827	7,827	7,827	7,827	7,827	7,827	223814
462	Recr. Retail	6,881	6,881	4,224	4,224	4,224	4,224	3,566	3,566	3,566	3,566	3,566	3,566	3,566	3,566	3,566	3,566	3,566	3,566	3,566	3,566	3,566	3,566	3,566	3,566	3,566	3,566	101982.5
463	Other Retail	9,438	9,438	5,794	5,794	5,794	5,794	4,891	4,891	4,891	4,891	4,891	4,891	4,891	4,891	4,891	4,891	4,891	4,891	4,891	4,891	4,891	4,891	4,891	4,891	4,891	4,891	139872
470	Real Estate	3,303	3,303	2,028	2,028	2,028	2,028	1,712	1,712	1,712	1,712	1,712	1,712	1,712	1,712	1,712	1,712	1,712	1,712	1,712	1,712	1,712	1,712	1,712	1,712	1,712	1,712	48956.25
471	Hotels and Lodging	20,645	20,645	12.674	12.674	12.674	12,674	10,699	10,699	10,699	10,699	10,699	10,699	10,699	10,699	10,699	10,699	10,699	10,699	10,699	10,699	10,699	10,699	10,699	10,699	10,699	10,699	305960
482	Mgmt.\Consult. Serv.	198,203	198,203	116,681	116,681	116,681	116,681	102,723	102,723	102,723	102,723	102,723	102,723	102,723	102,723	102,723	102,723	102,723	102,723	102,723	102,723	102,723	102,723	102,723	102,723	102,723	102,723	2917580
489	Engineering\Arch. Serv.	2,360	2,360	1,449	1,449	1,449	1,449	1,223	1,223	1,223	1,223	1,223	1,223	1,223	1,223	1,223	1,223	1,223	1,223	1,223	1,223	1,223	1,223	1,223	1,223	1,223	1,223	34970.875
491	Eat\Drink. Places	12,386	12,386	7,605	7,605	7,605	7,605	6,419	6,419	6,419	6,419	6,419	6,419	6,419	6,419	6,419	6,419	6,419	6,419	6,419	6,419	6,419	6,419	6,419	6,419	6,419	6.419	183567.5
492	Auto Rental\Leasing	15,730	15,730	9,656	9,656	9.656	9,656	8,153	8,153	8,153	8,153	8,153	8,153	8,153	8,153	8,153	8,153	8,153	8,153	8,153	8,153	8,153	8,153	8,153	8,153	8,153	8.153	233135
Harvest																												
433	Sporting Goods																											
462	Recr. Retail							52,222	61,546	72,535	85,486	100,750	118,739	139,940	164,926	194,374	229,080	269,982	318,187	375,000	441,956	520,867	613,868	723,475	852,651	5,335,584		
471	Hotels and Lodging							25,600	30,171	35,558	41,906	49,389	58,207	68,600	80,849	95,284	112,297	132,348	155,978	183,828	216,651	255,334	300,924	354,654	417,978	2.615.556		
484	Equip. Rep.\Leas.							489	576	679	800	943	1,111	1,310	1,544	1,819	2,144	2,527	2,978	3,510	4,136	4,875	5,745	6,771	7,980	49,934		
491	Eat\Drink. Places							19,562	23,055	27,171	32,023	37,741	44,479	52,421	61,781	72,812	85,812	101,134	119,191	140,473	165,555	195,114	229,952	271,010	319,399	1,998,685		
499	Comm. Sports							4,272	5,035	5,934	6,994	8,242	9,714	11,448	13,492	15,901	18,741	22,087	26,030	30,678	36,156	42,611	50,220	59,186	69,754	436,496		
521	Other St.\Loc. Enter							742	875	1,031	1,215	1,432	1,688	1,990	2,345	2.763	3.257	3,838	4,524	6.331	6,283	7.405	8,727	10,286	12,122	75,855		
		316,587	746,974	1,210,128	1,261,727	1,313,326	971,852	926,446	926,446	1,029,333	1,047,704	1,069,354	1,094,870	1,124,943	1,160,384	1,202,154	1,251,382	1,309,399	1,377,776	1,458,361	1,553,335	1,665,266	17797,183	1,952,653	2,135,883	2,351,828	2,606,330	

Source: Derived from information oresented in Tables 5.2-5.9.

Table K.3. Direct Impacts for Klickitat County, 1990-1995.

Implan Number		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Construction																												
47	Crushed Stone		3,065	45,255	45,255	45,255	42,189																					181,019
48	Sand and Gravel		3,065	16,566	16,566	16,566	13,501																					66,264
66	Res. Structures			30,130	30,130	30,130	30,130																					120,521
67	Indust. Structures		13,996	48,311	48,311	48,311	34,315																					193,245
68	Utility Structures		12,504	131,090	131,090	131.090	118,586																					524,360
69	Highway and Street		10,648	164,230	164,230	164,230	153,582																					656,920
72	Govt. Facilities		3,993	111,325	111,325	111,325	107,332																					445,302
267	Concrete Block		1,597	29,723	29,723	29,723	28,125																					118,890
269	Ready-Mixed Conc.		15,650	100,029	100,029	100,029	84,379																					400,116
308	Fabricated Metals		2,743	2,743	2,743	2,743																						10,971
453	Travel Agency																											
461	Other Wholesale		234	234	234	234																						938
463	Other Retail		123	27,297	27,297	27,297	27,174																					109,186
468	Ins. Agents\Brok.			3,565	3,565	3,565	3,565																					14,260
470	Real Estate			31,126	31.126	31,126	31,126																					124,504
471	Hotels and lodging																											
481	Computer Services																											
489	Engineering\Arch. Serv.																											
491	Eat\Drink. Places																											
493	Auto Repair\Service																											
518	Fed. govt. Enter.																											
Operations and Maintenance																												
	Harvest																											
74	Maint. and Repair							212.729	212,729	212,729	212,729	212,729	212,729	212,729	212,729	212,729	212,729	212,729	212,729	212,729	212,729	212,729	212,729	212,729	212,729	212,729	212,729	4,254,580
103	Prepared Feeds, N.E.C							163,470	163,470	163,470	163,470	163,470	163,470	163,470	163,470	163,470	163,470	163,470	163,470	163,470	163,470	163,470	163,470	163,470	163,470	163,470	163,470	3,269,400
461	Other Wholesale							1,710	1,710	1,710	1,710	1,710	1,710	1,710	1,710	1,710	1,710	1,710	1,710	1.710	1,710	1,710	1,710	1,710	1,710	1.710	1,710	34.209
463	Other Retail							23,353	23,353	23,353	23,353	23,353	23,353	23,353	23,353	23,353	23,353	23,353	23,353	23,353	23,353	23,353	23,353	23,353	23,353	23,353	23,353	467,059
520	St. and Loc. Utility							41,597	41.597	41,597	41,597	41,597	41,597	41,597	41,597	41,597	41,597	41,597	41,597	41.597	41,597	41,597	41,597	41,597	41.597	41,597	41,597	831,940
	Phase II																											
74	Maint. and Repair																											
461	Other Wholesale																											
463	Other Retail																											
493	Auto Rep.\Service																											
520	St. and Loc. Utility																											
	Enhancement																											
413	Mobile Homes																											
462	Recr. Retail																											
518	Fed. Govt. Enter.																											
520	St. and Loc. Utility		1,113	1,113	1,113	1,113	1,113	1,113	1,113	1,113	1,113	1,113	1,113	1,113	1,113	1,113	1,113	1,113	1,113	1,113	1,113	1,113	6,888	1,113	1,113	1,113	1.113	27,813
525	Govt. Industry		6,888	6,888	6,888	6,888	6.888	6,888	6,888	6,888	6,888	6,888	6,888	6,888	6,888	6,888	6,888	6,888	6,888	6,888	6,888	6,888	6,888	6,888	6,888	6,888	6 , 8 8 8	172.188
Experimentation and Monitoring																												
68	Utility Structures	7,275	7,275	4,466	4,466	4,466	4,466	3,770	3,770	3.770	3,770	3,770	3,770	3,770	3,770	3,770	3,770	3,770	3,770	3.770	3,770	3,770	3,770	3,770	3,770	3,770	3,770	107,822
365	Office Mach. N.E.C	12,976	12,976	7,966	7,966	7,966	7,966	6,725	6,725	6,725	6,725	6,725	6,725	6,725	6,725	6,725	6,725	6,725	6,725	6,725	6,725	6,725	6,725	6,725	6,725	6.725	6.725	192.318
450	Air Transportation																											
453	Travel Agency	3.775	3,775	2,318	2,318	2,318	2,318	1,957	1,957	1.957	1,957	1,957	1,957	1,957	1.957	1,957	1,957	1,957	1,957	1,957	1,957	1,957	1,957	1,957	1,957	1.957	1,957	55.950
462	Recr. Retail	3,933	3,933	2,414	2.414	2.414	2,414	2,038	2,038	2,038	2,038	2,038	2,038	2,038	2,038	2,038	2,038	2,038	2,038	2,038	2,038	2,038	2,038	2,038	2,038	2.038	2.038	58.270
463	Other Retail	7,078	7,078	4,345	4,345	4,345	4.345	3,668	3,668	3.668	3,668	3,668	3,668	3,668	3,668	3,668	3,668	3,668	3,668	3,668	3,668	3,668	3,668	3,668	3,668	3.668	3,668	104,896
470	Real Estate	2,477	2,477	1,521	1,521	1,521	1.521	1,284	1,284	1,284	1,284	1,284	1,284	1,284	1,284	1,284	1,284	1,284	1,284	1,284	1,284	1,284	1,284	1,284	1,284	1.284	1,284	36.719
471	Hotels and Lodging	11,798	11,798	7,243	7,243	7,243	7,243	6,114	6,114	6,114	6,114	6,114	6,114	6,114	6,114	6,114	6,114	6,114	6,114	6,114	6,114	6,114	6,114	6,114	6,114	6.114	6,114	174,840
482	Mgmt.\Consult. Serv.	132,135	132,135	81,120	81,120	81,120	81,120	68,481	68.481	68,481	68,481	68,481	68,481	68,481	68,481	68,481	68,481	68,481	68,481	68.481	68,481	68,481	68,481	68,481	68,481	68.481	68,481	1,958.375
489	Engineering\Arch. Serv	787	787	483	483	483	483	408	408	408	408	408	408	408	408	408	408	408	408	408	408	408	408	408	408	408	408	11.657
491	Eat\Drink. Places	7,078	7,078	4,345	4,345	4,345	4,345	3,668	3,668	3,668	3,668	3,668	3,668	3,668	3,668	3,668	3,668	3,668	3,668	3.668	3,668	3,668	3,668	3,668	3,668	3.668	3,668	104.885
492	Auto Rental\Leasing	11,798	11,798	7,243	7,243	7,243	7,243	6,114	6,114	6,114	6,114	6,114	6,114	6,114	6,114	6,114	6,114	6,114	6,114	6,114	6,114	6,114	6,114	6,114	6,114	6.114	6.114	174.840
	Harvest																											
433	Sporting Goods									1,158	1,365	1,609	1,896	2,235	2,634	3,104	3,659	4,312	5,082	5,989	7,059	8,319	9,804	11,555	13,618	16.049	18,915	118,364
462	Recr. Retail									55,742	65,695	77,425	91.249	107,542	126,743	149,373	176,044	207.477	244,522	288.181	339,636	400,278	471,748	555,979	655,249	772,244	910,129	5,695,257
471	Hotels and Lodging									20,839	24,560	28,945	34,113	40,204	47,383	55,843	65,813	77,565	91,414	107,736	126,972	149,643	176.362	207.851	244,963	288,701	340.249	2,129,153
484	Equip. Rep.\Leas.									307	362	426	502	592	698	822	969	1,142	1,346	1,586	1,869	2,203	2,596	3,060	3,606	4.250	5,009	31,343
491	Eat\Drink. Places									17,120	20,177	23,780	28,026	33,030	38,927	45,877	54,069	63,723	75,101	88,510	104,313	122,938	144.889	170,759	201,248	237,181	279.530	1,749,199
499	Comm. Sports									3,840	4,526	5,334	6,287	7,409	8.732	10,291	12,128	14,294	16,846	19.854	23,399	27,577	32,501	38,304	45,143	53,203	62,702	392,369
521	Other St.\Loc. Enter.									673	793	934	1,101	1,298	1,530	1.803	2,125	2,504	2,951	3,478	4.099	4,831	5.693	6.710	7,908	9,320	10.984	68.732
		201, 108	276,727	873,086	873,086	873,086	805,468	555,085	555,085	654,764	672,562	693,538	718,259	747,394	781,730	822,198	869,891	926,100	992,345	1,070,418	1,162,431	1,270,873	1,398,678	1,549,302	1,726,820	1,936,033	2,182,602	

Source: Derived from information presented in Tables 5.2-5.9.

SOURCES CITED

Braschler, Curtis H. 1972. A Comparison of Least-Squares Estimates of Regional Employment Multipliers with Other Methods. Journal of Regional Science, 12: 457-468.

Bruckner, S. M., S. E. Hastings, and W. R. Latham. 1987. Regional Input-Output Analysis: A Comparison of Five 'Ready Made' Model Systems. The Review of Regional Studies, 17, 2: l-29.

Burcher, Willis, and Ratliff. 1985. Target Industry Market Analysis: Yakima County, Washington. Kansas City, Missouri: Consulting Engineers, Planning and Architects.

Donnelly, Dennis M., John B. Loomis, Cindy F. Sorg, and Louis J. Nelson. 1985. Net Economic Value of Recreational Steelhead Fishing in Idaho. United States Department of Agriculture, Forest Service. Resource Bulletin RM-9. Fort Collins, Colorado (April).

Fish Management Consultants. 1987. Yakima and Klickitat Rivers Central Outplanting Facility, Proposed Master Plan. Prepared for Northwest Power Planning Council.

Glickman, Norman H. 1971. An Econometric Forecasting Model for the Philadelphia Region. Journal of Regional Science, 11, 1: 15-32.

Hall, Owen P., and Joseph A. Licari. 1974. Building Small Region Econometric Models: Extension of Glickman's Structure to Los Angeles. Journal of Regional Science, 14, 3: 337-353.

Henson, Steven E., and David E. Merrifield. 1987. An Econometric Employment and Income Model for Whatcom County, Washington. Department of Economics, Western Washington University. Mimeo (draft).

Hess, Samuel S., and Steven D. King. 1987. The 1987 Lower Columbia River (Bonneville to Astoria) and Estuary Salmon (Buoy 10) Recreational Fisheries. State of Oregon, Department of Fish and Wildlife.

Hull-Griswold, Judy, and Tim Cochnaeur. 1987. Job Performance Report, Project F73R8 Salmon and Steelhead Investigation. State of Idaho, Department of Fish and Game.

Kuehn, J. A., M. H. Proctor, and Curtis H. Braschler. 1985. Comparisons of Multipliers from Input-Output and Economic Base Models. Land Economics, 61: 129-135.

Latham, William R., Kenneth A. Lewis, and John H. Landon. 1979. Regional Econometric Models: Specification and Simulation of a Quarterly Alternative for Small Regions. Journal of Regional Science, 19: l-13.

Loveman, G. W., and Chris Tilly. 1988. God Jobs or Bad Jobs: What Does the Evidence Say? New England Review (January/February).

Morris, Kathleen, and Randy Anderson. 1988. Tourism in the Columbia Gorge: A Profile of Visitors' Accommodations and Economic Impacts. Washington Sea Grant Marine Advisory Services, University of Washington: Seattle, Washington.

Oregon State University, Department of Agricultural and Resource Economics. 1978. Socio-Economics of the Idaho, Washington, Oregon and Callfornia Coho and Chinook Salmon Industry. Final Report to the Pacific Fishery Management Council. Corvallis, Oregon (October).

Radtke, H. E., and W. Jensen. 1986. The West Coast Seafood Industry: Its Importance to the West Coast Economy in 1986. Paper prepared for Pacific Marine Fisheries Commission, Portland, Oregon.

Romanoff, Eliahu. 1974. The Economic Base Model: A Very Special Case of Input-Output Analysis. Journal of Regional Science, 14: 121-129.

Scott, M. M., et. al. 1987. The Economic and Community Impacts of Closing Hanford's N Reactor and Nuclear Materials Production Facilities. Prepared for Battelle Memorial Institute, Pacific Northwest Laboratory, Hanford, Washington.

Sorhus, Colin N., William G. Brown, and Kenneth C. Gibbs. 1981. Estimated Expenditures by Salmon and Steelhead Sport Anglers for Specified Fisheries in the Pacific Northwest. Special Report 631. Agricultural Experiment Station, Oregon State University, Corvallis, Oregon (July).

State of Oregon, Department of Fish and Wildlife. 1989. Survey and Economic Impact Analysis of the 1988 Willamette Run Spring Chinook Sports Fishery. Prepared by The Research Group, Corvallis, Oregon (January).

State of Washington, Department of Community Development. 1988. Economic Impacts and Net Economic Values Associated with Non-Indian Salmon and Sturgeon Fisheries. Prepared by ICF, Incorporated.

Taylor, Carol A. 1982. Econometric Modeling of Urban and Other Substate Areas--An Analysis of Alternative Methodologies. Regional Science and Urban Economics, 12: 425-48.

U.S. Department of Commerce, Bureau of Economic Analysis, Regional Economic Analysis Division. 1975. The BEA Economic Areas: Structural Changes in Growth, 1950-1973. A Survey of Current Business, 2:55, (November).

U.S. Department of Commerce, National Marine Fisheries Service. 1988. Economic Activity Associated with Marine Recreational Fishing in 1985, Volume II--National and Regional Estimates. Prepared by Sport Fishing Institute.

U.S. Department of Commerce, National Marine Fisheries Service. 1988. Economic Activity Associated with Marine Recreational Fishing in 1985, Volume III--Future Participation in Marine Recreational Fishing. Prepared by Sport Fishing Institute.

U.S. Department of Energy, Bonneville Power Administration, Office of Power Sales. 1987. Draft Environmental Assessment, Yakima-Klickitat Production Project. Portland, Oregon.